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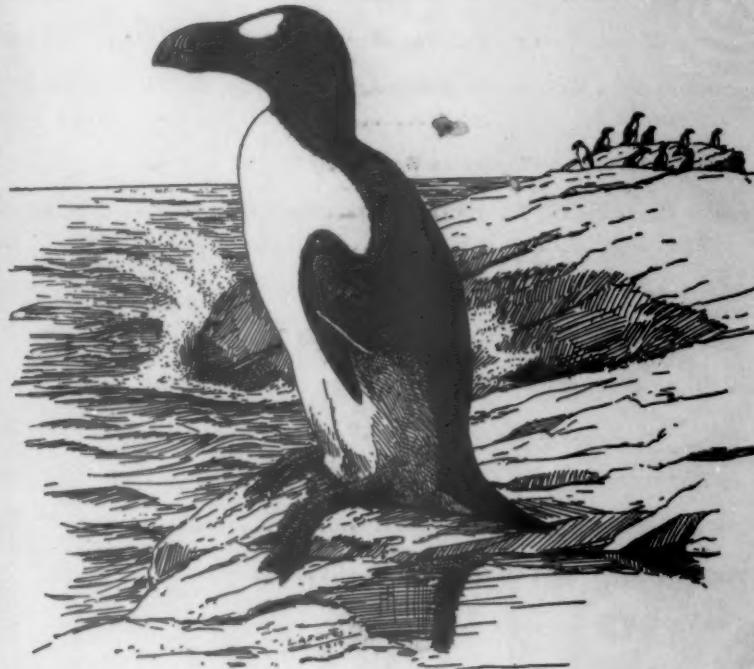
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THE DOWNTY YOUNG OF *DENDRAGAPUS*

BY JAMES MOFFITT

Plate 19

ALLAN BROOKS (Auk, 29: 252-253, 1912, and 43: 281-287, 1926) and Swarth (Univ. California Publ. Zool., 24: 204, 1922, and 30: 73-85, 1926) have pointed out marked variations in the hooting apparatus, notes and shapes of tails among grouse of the genus *Dendragapus* that led the A.O.U. in the 'Check-list' of 1931 to recognize two species: *obscurus* of the Rocky Mountains, with three races and *fuliginosus* of the Pacific Coast, Cascade and Sierra Nevada Mountains, embracing four subspecies. Peters ('Check-list of Birds of the World,' 2: 28-29, 1934), however, considered all as belonging to the single species *obscurus*. Thus, notwithstanding trenchant

EXPLANATION OF PLATE 19 (opposite)

DOWNY YOUNG OF *Dendragapus*

FIG. 1.—DUSKY GROUSE, *Dendragapus obscurus obscurus* (Say). ♂, New Castle, Colorado, July 20, 1902; no. 8071 collection of Louis B. Bishop.

FIG. 2.—RICHARDSON'S GROUSE, *Dendragapus obscurus richardsoni* (Douglas). ♂, Okanagan Landing, British Columbia, June 5, 1936; no. 8288 collection of Allan Brooks.

FIG. 3.—MOUNT PINOS GROUSE, *Dendragapus fuliginosus howardi* Dickey and Van Rossem. ♂, 2 miles northeast of Mt. Pinos, 8000 feet, Kern County, California, June 11, 1929; no. 54126 Mus. Vert. Zool.; weight 22.5 grams.

FIG. 4.—SIERRA GROUSE, *Dendragapus fuliginosus sierrae* Chapman. ♂, near Martin Creek, 5700 feet, near Mineral, Tehama County, California, June 17, 1925; no. 45866 Mus. Vert. Zool.; weight 13.8 grams.

FIG. 5.—SITKA GROUSE, *Dendragapus fuliginosus sitkensis* Swarth. ♀ (?), Hooniaha, Chichagof Island, Alaska, June 25, 1907; no. 152 Mus. Vert. Zool.

FIG. 6.—SIERRA GROUSE, *Dendragapus fuliginosus fuliginosus* (Ridgway). Sex? (not recorded), Coyote Peak, 3000 feet, Humboldt County, California, June 11, 1933; no. 62907 Mus. Vert. Zool.; weight 16.8 grams.

All figures two-thirds natural size.

differences in vocal apparatus and sound of adult males, consistent tail variations of both sexes and absence of known intergradation of any sort between members of the two groups, it appears still to be controversial whether one or two species of *Dendragapus* should be recognized. It now turns out that color of the downy young, considered to be rather fundamental or recessive in nature, must be added to the list of characters separating the grouse of these groups. It is not the purpose of this paper to enter this controversy, but the A.O.U.'s classification will be followed as perhaps best illustrating the relationships of the members of the genus. Nor will the question be considered here of the validity of the subspecies *flemingi*, which Swarth (Proc. California Acad. Sci., (4) 20: 1-7, 1931) claimed to be identical with *richardsoni*, since its downy young was not examined. The writer recognizes Swarth's (loc. cit.) *pallidus* as a valid form, but it appears to be restricted in range to the mountains of eastern Oregon and possibly of Washington. Recent examination of a number of adult specimens from the vicinity of Okanagan Landing, British Columbia, indicates that this grouse population is closer to *richardsoni* of the Rocky Mountains of that province than to *pallidus*. Accordingly, the specimen from Okanagan Landing here figured, is designated as *richardsoni* and the downy young of *pallidus* is not mentioned since none was seen.

Swarth (supra cit., p. 76), in comparing the natal down of '*flemingi*' (= *richardsoni* ?) from the Atlin region with similar plumages of *sitkensis* and *fuliginosus*, remarked that the former is much less yellow, more gray, than are young of the coastal birds. This observation appears to have been overlooked by Bent ('Life Histories of Gallinaceous Birds,' p. 108, 1932) who describes only the downy chick of *fuliginosus* and states that in full juvenal plumage the racial characteristics begin to show. This statement was doubtless made because insufficient specimens in neossoptile down were available, for there are but few in most museums, especially in eastern ones. Examination of a number of small chicks of six races of *Dendragapus* reveals marked differences between members of the two groups or species and in most cases sufficient variation among forms of the *fuliginosus* group to permit of their subspecific identification.

The differences in the downy young of *Dendragapus* are more satisfactorily shown in the colored plate (Plate 19) accompanying this paper than it is possible to indicate by word descriptions.

In the course of this study, material in addition to the specimens here figured was examined. My sincere thanks are due to the authorities in charge of the museums and to the owners of private collections whence specimens were borrowed, for the privilege of using same. Especial thanks are due Dr. Joseph Grinnell for making the magnificent series of downy young grouse in the Museum of Vertebrate Zoology available and for

permission to send four of them to Major Brooks as subjects for the plate. Similar thanks are due Dr. Louis B. Bishop and Major Brooks for furnishing the specimens figured of *obscurus* and *richardsoni*, respectively. I am further indebted to Major Brooks for the great pains he took in preparing the original painting which provides faithful reproductions of the young birds and for advice on matters pertaining to the preparation of this manuscript.

The study was limited to young birds still clothed entirely in natal-down contour plumage, with three exceptions noted beyond in which more or less juvenal dress has been assumed. The strictly downy chicks (eliminating the latter three specimens) vary from the very small *sierrae* figured (M.V.Z. 45866) in which the secondaries are just bursting their sheaths (entire weight 13.8 grams) to the largest (C.A.S. 29073, *fuliginosus*) which could probably just have flown. In this specimen the rectrices are 14 mm. long and the first juvenal contour feathers are just appearing on the sides of the upper breast. Unfortunately I lack information on the development of young grouse hatched and reared in captivity; but judging from downy chickens, M.V.Z. 45866 could not be more than two days old and the largest, C.A.S. 29073, less than ten days in age. The *richardsoni* figured (A. Brooks 8288) is very slightly larger than the small *sierrae* and its label indicates that remains of yolk were found in the stomach, in addition to nine black Coleoptera 5 mm. long. This would indicate that its age was about two days. Two of four young collected by me in Mendocino County, California, May 16, 1937 (J. Moffitt nos. 2049-50), weighed 18.3 and 18.4 grams, respectively. Their remiges were less than half developed and they could not fly. These birds were thought to be about four days old and represented the average development of most specimens examined. Surely few, if any, of the skins used in this study (excluding again the three juvenals) could have been much over one week old when collected. Probability of changes in coloration through plumage development and fading within this period is recognized to exist, also of fading after death, but because the extent of any such changes is unknown to me for any one brood, they are not considered here, nor are they thought sufficient to affect materially the conclusions here advanced. A total of twenty-one true downies was examined, of which seven are of the *obscurus* group and the remainder of the coastal aggregation. This material, rare in most collections, warrants detailed comment, necessary for an understanding of variation within the two groups.

In addition to the two representatives of the *obscurus* group figured, a chick from the same brood as the *richardsoni* (A. Brooks 8288), identical in every way including data, was examined in the H. B. Conover collection (no. 12075), in the Field Museum of Natural History; also the following specimen referable to *richardsoni*: Philadelphia Academy of Natural Sci-

ences 70669 (sex not recorded), Burmis, Alberta, June 16, 1926. The latter, about the same size as the Okanagan chicks, is intermediate between them and the Colorado specimen in coloration, being somewhat browner above and on the breast, flanks and thighs. It emanates from a locality known to be inhabited by typical *richardsoni*. U. S. National Museum 222615, ♀? juv., Moose Pass (near Yellowhead Pass), British Columbia, July 27, 1911, is in nearly complete juvenal dress but retains sufficient natal down ventrally to show that it was a pale-gray chick. Its locality is closest to the restricted type locality of *richardsoni* (Jasper House) of any specimen examined. U. S. National Museum 62219 (unsexed), Teton Canyon, Idaho, July 30, 1872, is in about half-assumed juvenal plumage, but is noteworthy because its remaining down is yellowish in color, and it is the only example of the *obscurus* group examined in which a suggestion of this color was indicated. I am not at all convinced, however, that this color is natural to the specimen for it appears more likely to be adventitious in nature. The third partly juvenal contour-plumaged bird included in this study, no. 1745 collection of Stanley G. Jewett, ♀ juv., Chelan County, Washington, August 3, 1918, retains considerable down on its head, interscapular region and ventral surface, that is gray or brownish, with practically no yellowish. Thus, this specimen which emanates from a locality thought to be inhabited by *fuliginosus* (though I have seen no adults from the vicinity), resembles the young of the *obscurus* group much more than coastal birds. Adult birds from the region should be examined critically.

Downy young of *D. o. obscurus*, additional to the specimen figured, were examined as follows:

U. S. Nat. Mus. 60221 (unsexed), Mountains of St. George, Utah, June 10 [year?].
Mus. Vert. Zool. 57321 ♂, Kingston R. S., 7500 feet, Lander County, Nevada, June 5, 1930; weight 27 grams.
Mus. Vert. Zool. 57322 ♂, same data; weight 24.5 grams.

The Utah specimen is slightly larger than the Colorado one figured and is very close to it in coloration, being rather brownish above and on the sides of the breast, flanks and thighs. The two Nevada downies, which are somewhat larger, are much less brownish in equivalent parts. They resemble closely the young of *richardsoni* figured, being blacker above and on the wings than *obscurus* and paler, more gray, less brownish on the breast, flanks and thighs. Indeed, there is little to distinguish these Nevada birds from the Okanagan Landing ones, save their slightly paler ventral surfaces. Linsdale (Amer. Midland Nat., 19: 51-52, 1938) considers these specimens referable to *pallidus* but I have examined adults in the Museum of Vertebrate Zoology from this county, which, because of their gray terminal tail bands, I can call only *obscurus*.

These chicks of the *obscurus* group indicate that the natal plumages of specimens from Colorado and Utah are more brownish than those from more arid, less-forested, semi-desert western localities including central Nevada and the Okanagan district where blacker-backed, ventrally paler-colored chicks are produced. The Burmis, Alberta, specimen is, as would be expected from its environment, closer to the Rocky Mountain young, but intermediate to the Okanagan specimens. It is noteworthy that this Alberta chick exhibits no marked darkening dorsally, as might have been expected from its dark-colored adults. Thus, variation in the limited number of young of the *obscurus* group available for this study, from a tremendous area suggests that climate and environment may play a stronger part in their differences than characters inherited from their parents.

Now, to consider the fourteen examples of the *fuliginosus* group studied, ten specimens of this species that were available, in addition to the four figured, bear the following data:

Mus. Vert. Zool. 15577-8 (not sexed), Alberni Valley, Vancouver Island, British Columbia, June 18, 1910.

A. Walker 9280 ♂, 9282 ♀, Tillamook, Oregon, June 5, 1933.

Calif. Acad. Sci. 29073 ♀, ten miles northwest of Forest Glen, 3100 feet, Trinity County, California, June 18, 1936.

Calif. Acad. Sci. 44365 ♀, Seaview, Sonoma County, California, May 12, 1908.

Mus. Vert. Zool. 19128 ♂, north fork of Coffee Creek, 4500 feet, Trinity County, California, July 8, 1911.

J. Moffitt 2047 ♂, 2048 ♀, five miles northwest of Yorkville, 1950 feet, Mendocino County, California, May 16, 1937.

Calif. Acad. Sci. 34873 sex?, near Mt. Whitney, California, "summer," 1904.

Only the specimen figured was available of the race *sitkensis*, but another of smaller size, similar to it in extreme reddish coloration, from the Queen Charlotte Islands, British Columbia, has been examined in the Conover collection. On the basis of adults examined from nearby localities, the specimens listed above, with exception of the last which is *howardi*, are considered closest to *fuliginosus*. But there is a wide range of variation in colors of these downies, as also in adults, from over this area.

Downies examined from the humid coast are extremely reddish in coloration. The Vancouver Island specimens are almost as red as the *sitkensis* figured, being perhaps a trifle blacker dorsally. The Tillamook specimens are equally reddish, but their ventral yellow is paler than in the preceding three specimens, being the shade of that in the *fuliginosus* figured. It is regretted that no downy of the latter race from near the type locality (Mt. Hood, Oregon), could be located for this study, but such inland specimens are probably paler than north-coastal birds, more like the one figured from Humboldt County, California. The California Academy of Sciences'

specimens from Trinity and Sonoma Counties, California, although of larger size than the *fuliginosus* figured, are very similar to it in coloration. No. 19128 Museum of Vertebrate Zoology, also a large downy, emanates from a region where intergradation between the coastal form and *sierrae* is known to occur. This is indicated by the specimen's pale ventral coloration, but it is more reddish dorsally than the other California downies thus far discussed. The two Mendocino County birds lean still more toward *sierrae*, being pale yellow below, yet brighter than *sierrae*, and they lack much of the dorsal redness of the other coastal specimens. These two chicks of a brood of four collected are interesting in showing that individual variation exists in the downy young of a clutch. No. 2047 is paler than the other and its remiges are more developed; its rump stripes are brown, while in the other they are black. The intermediate nature of these chicks' plumages between those of *fuliginosus* and *sierrae* was to be expected, for adults from the locality are likewise intermediate with individual variation completely bridging the gap between the two races.

The chick of *sierrae* figured is the only representative of that race available for study. Its similarity to the young of *howardi* is apparent, but the former is less reddish, more blackish, dorsally and slightly brighter yellow ventrally. California Academy of Sciences 34873, *howardi*, is of the same size as the one figured and closely matches it in coloration, though perhaps a trifle darker dorsally and brighter yellow ventrally, thus being intermediate between the *sierrae* and *howardi* of the plate.

As regards the *fuliginosus* group, the study indicates that young from the humid coast north of California are very reddish in color. There is little difference between those of *sitkensis* and of *fuliginosus* from Vancouver Island, while downies from coastal Oregon are similarly reddish, but paler yellow. Young from coastal California are still paler in color with redness especially reduced. This is more noticeable in specimens from inland localities where it probably represents a trend toward, or intergradation with, *sierrae*. The young of the last race and of *howardi* are extremely pale in coloration as compared with other representatives of the species and are quite similar; the former is slightly darker than the latter. Thus in the *fuliginosus* group, as in the *obscurus* aggregation, it is seen that young from areas of higher humidity and denser plant growth are much browner or reddish and brighter in pigmentation. Yet even in the pale *howardi* of the southern Sierra Nevada, yellow is characteristic of the ventral tone, while this color is found lacking in representatives of the *obscurus* group.

SUMMARY

Examination of twenty-one downy specimens of the genus *Dendragapus* indicates that those of the *obscurus* group are essentially grayish birds

ventrally, a consistent difference from the yellowish chicks of the *fuliginosus* group. Further, that in both groups, browns and reds predominate in specimens from humid or heavily forested regions as compared with those from more arid localities, which are paler in general coloration, especially ventrally. Variation exists in the downy young of most races examined to an extent comparable to that present in adult plumages and sufficient to provide satisfactory subspecific identifications.

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PARTIAL NIDIFICATION OF THE FLIGHTLESS CORMORANT

BY MALCOLM DAVIS

Plate 20

AFTER three years of courtship and several attempts at nesting, the pair of Flightless Cormorants (*Nannopteron harrisi*) that have lived in captivity for four years in the National Zoological Park, Washington, D. C., succeeded in completing a nest and depositing four eggs. The courtship that preceded this activity was unique and was for the first time witnessed by ornithologists as reported by Davis and Friedmann (Scientific Monthly, 560, June, 1936).

The pair of birds repeated this queer courtship during May and early June of 1936, and afterward attempted to build a nest. The site selected was at the foot of a willow tree near the border of the pond in which the birds were inclosed. Both sexes took part in the building of the structure, which was merely a heap of large twigs, feathers and straw that were introduced for this purpose. During the nest-building activity which was accompanied by much carrying of material in the beaks of the birds, and many guttural calls, copulation took place frequently. At times this act was completed in the water and again near or on the nest.

The first egg was deposited on June 1, the second on June 3, the third on the 4th and the last egg on the 8th. The female as she covered the eggs, gave promise of being a good mother. She left the nest in the morning for a swim, and again in the afternoon at about two o'clock, the feeding time of the pair of birds. Frequently she would refuse to leave the nest; therefore it became necessary for me to approach her while she incubated, and feed her from my hand. (The usual procedure of feeding is by tossing the fish into the pond, and the birds then make long underwater dives for the food.) The female would allow no one near her nest site. It became necessary to remove a pair of Mute Swans (*Sthenelides olor*) from the inclosure, as the hooked beaks of the cormorants are weapons to be respected. Two of the eggs were crushed by the large webbed feet of the female during incubation. In Nature the loss from this source is no doubt high, as the four toes are connected by a web, thus forming a damaging foot structure. The eggs were a pale bluish white, more or less overlain with chalky deposits of lime; size 2.50 by 1.50 inches. On several occasions I saw the bird turn her eggs by pushing them around with her long, hooked beak. It appeared a clumsy procedure. The female performed all the duties of incubation, while the male stood nearby, occasionally bringing in his beak a few offerings of straw or sticks which he gave to his mate. She accepted the material and placed this offering as an addition to the nest. Again, when the male came close to

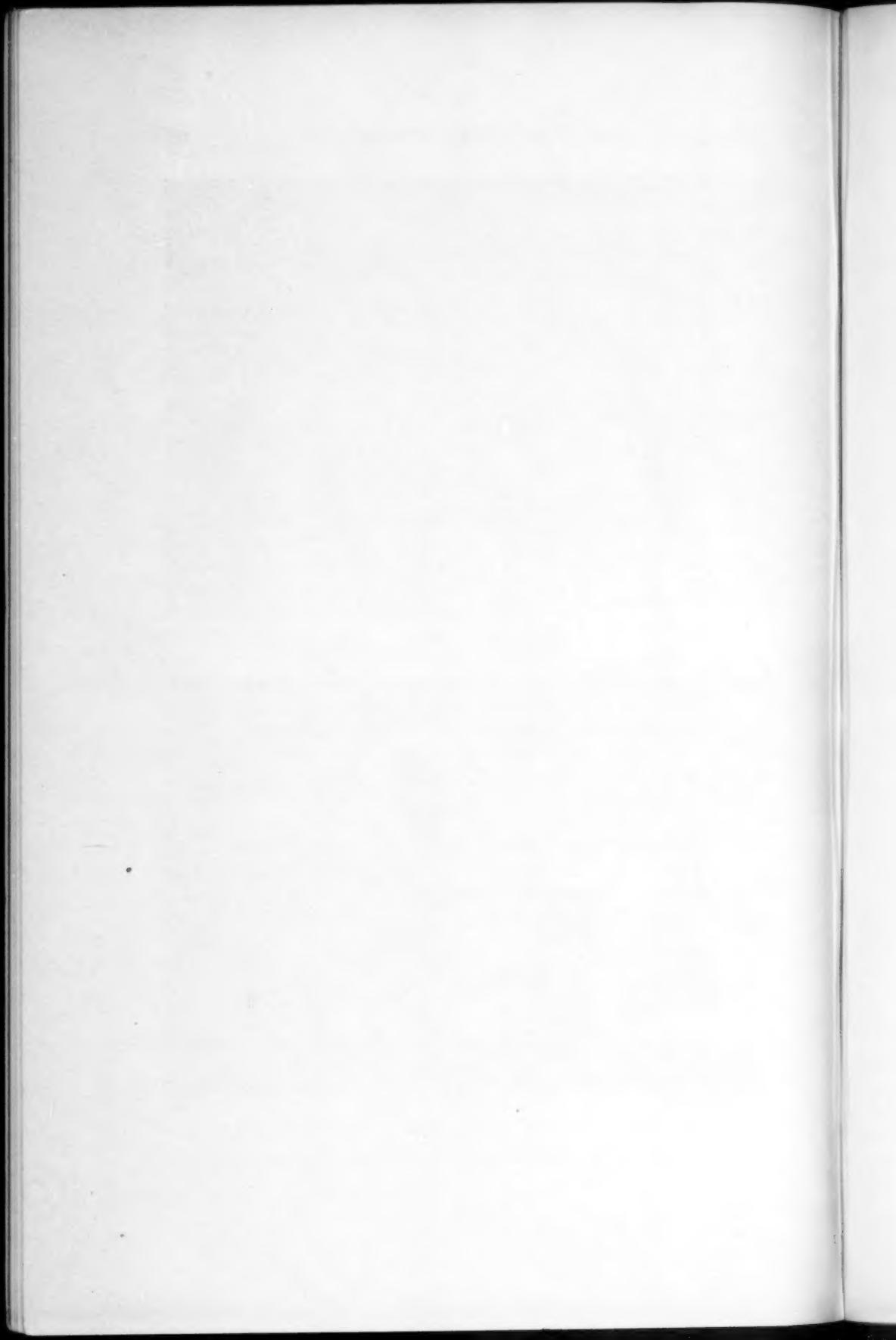


FIG. 1.—IN 1936



FIG. 2.—IN 1935

PARTIAL NIDIFICATION OF THE FLIGHTLESS CORMORANT



the nest the female would spar with him, using her beak in a vicious manner, although no wounds were inflicted. The male appeared bored while his mate performed the duties of incubation. His pastime consisted of swimming and diving after nesting material, a good portion of which he dropped before he reached the nest.

The nest site was on the edge of the pool in an exposed position which subjected the incubating female to the rays of the sun. Although the native home of the cormorants is in the equatorial Galapagos Islands, the bird appeared to suffer from the intense heat, as evidenced by the pulsating movements of the throat. The eggs remained in the nest for thirty days, and then were removed, examined and found to be infertile. The photograph (Plate 20, fig. 1) shows the incubating female, and the male on the edge of the pool. The female performed the entire duties of incubation. During courtship and the breeding activities the birds went through a molt. By July 15 and 16 after the removal of the infertile eggs, the birds made no further attempt to nest, and their molting was complete. There was no postnuptial molt, as is the rule among other birds. The above description of the nesting activities is probably the only one that is recorded in the literature of ornithology. We looked forward to the next spring with the anticipation that renewed sexual activity would be a real success, and that the National Zoological Park would have in its collection a brood of young Flightless Cormorants, but this, however, was not realized.

The previous year, 1935, the birds made an unsuccessful attempt to nest. After the courtship was completed, a nest was constructed at the base of the larger willow tree that occupies the inclosure. After a summer of nest building and much intense preparation, autumn arrived without the deposition of eggs. However, the female continued to sit on the nest until, due to the length of time that the birds allotted to nest building, it became a large and somewhat untidy affair. Plate 20, fig. 2, depicts the male in the act of courtship,—note the twisted neck. The female sits on the nest with material in her bill that her mate has offered her.

*National Zoological Park
Washington, D. C.*

FLORIDA CRANE A RESIDENT OF MISSISSIPPI

BY E. A. McILHENNY

Plates 21, 22

ON April 8, 1938, while visiting Mr. James R. Leavell, of Chicago, at his winter home about eight miles south and east of Ocean Springs, Mississippi, in a section of the Mississippi coast known as Pointe aux Chènes, I was informed that there were Sandhill Cranes in the vicinity. Seriously doubting this information, I answered that most likely the person who had reported Sandhill Cranes had seen Great Blue Herons, as the birds are similar. Later that same afternoon, Mr. Leavell, Mr. Leslie L. Cook, Mr. H. P. Flateau and myself, driving in Mr. Leavell's station wagon, went to see Mr. Ernest Carroll, who had reported the cranes, and who works for Mr. Flateau. Carroll lives at Fontainebleau Farm, which is about seven miles east of Ocean Springs, on U. S. Highway 90. Carroll had told Mr. Flateau that he had found a Sandhill Crane's nest during the spring of 1937 in a sparse wet pinewood section known as Bear Pond.

Proceeding to Carroll's house, I questioned him carefully, and he described the bird so accurately, also giving an imitation of the call, the location of the nest, and the size and color of the eggs, that I was confident he had seen Florida Cranes (*Grus canadensis pratensis*), their nest and eggs. On asking him if he could show me the nest which he had found the year before, he stated that he could, and proceeded to take us about three miles out on Highway 59 which runs north from Highway 90 near Fontainebleau. He stopped at Wiley Shumaker's house, a considerable distance out in the open pinewoods on a logging road, stating that Shumaker lived near a place where Sandhill Cranes were often seen. Shumaker told us that Sandhill Cranes passed his house every day going to and from Bear Pond and their roosting grounds to the east, and that he had seen Sandhill Cranes that morning. He also stated that he had killed Sandhill Cranes when they had passed near his house. He described the birds accurately, as well as their nests and eggs.

Bear Pond is only about a half mile from Shumaker's house, and on Carroll's telling us that he could take us to the old nest, which I was anxious to see, we drove a short distance through the woods, left the car and walked across the level, wet, sparsely timbered pine flat. Two of the party lagged behind because of the heavy going, but Mr. Leavell and I followed Carroll to the edge of Bear Pond, where Carroll stopped. I then asked him just where the nest was located, and he pointed to a low, cypress bush, about one hundred feet from where we stood, and said it was near that cypress.

It was then that I saw the head and neck of a Sandhill Crane, and could

make out the outline of its body sitting on what appeared to be a slight mound. I called the bird to Carroll's attention, and he said that he had seen the red spot on the bird's head but thought it was a Red-bird (*Richmondena cardinalis magnirostris*), meaning a male Cardinal. As we walked toward the crane, it took wing, flying directly toward us, passing not more than twenty feet in front and not ten feet above us (Plate 21). Gaining the altitude of the trees, it flew west across the open woods for about a quarter of a mile, and joined its mate who was seen to rise to meet it. All the while this bird was calling and croaking in the typical voice of the Sandhill Crane. The two birds started toward us, but one of them alighted on the ground in an opening, and the other bird came back and circled near us, then turned back to its mate, who joined it in the air. Then, the two birds circled near us, flying below the tops of the trees and giving their peculiar and never-to-be-forgotten call. After making a couple of circles near us, they alighted in the open woods about 150 yards away, remaining in plain sight all the while we were near the nest.

I thought it unwise to touch the nest or to go immediately to it, but we went within six feet of it and could plainly observe the two elongated, oval, dry-grass-colored eggs which were sparsely spotted all over and heavily spotted toward the larger end with burnt umber brown (Plate 21). Carroll said the eggs were deposited in the same nest in which he had seen eggs at about the same time in 1937.

The nest was situated on the ground in about six inches of water and was built up about twelve or fourteen inches above the water (Plate 21). It was about four feet across, constructed of dry grass and dry weed stalks with some small, dry pine twigs showing; it was slightly depressed in the center and was typical of the nests of the Sandhill Cranes that I have seen elsewhere, more especially in Florida, Dakota, western coastal Louisiana, and Manitoba, when these birds were still plentiful and shot as game. I can remember Sandhill and Whooping Cranes so plentiful in the late 'seventies at Avery Island, Louisiana, that guards were placed in the sweet-potato fields to protect the crop, for these large birds dug and ate the potatoes in great quantities. We did not disturb the nest in any way, or approach immediately to it.

Later, we questioned John King who works for Mr. Flateau. King stated that he had lived in this vicinity for forty years and had seen Sandhill Cranes at all times of the year, had often seen their nests, eggs and young. He said these birds passed his house daily, and since the turn of this year (1938) he had seen as many as nine at one time in his field. He stated that two or three pairs nest regularly in Bear Pond and that a number of cranes are resident in the vicinity of Martin's Bluff, about eight miles east of Bear Pond. He said that at this time of year, cranes are mostly in pairs and

stay in the vicinity of their nests, but later in the year they go in flocks and congregate every evening at Crane Meadow, a short distance east of his house, where they spend the night.

He described Crane Meadow as being about forty acres in extent, a grassy flat covered with shallow water with a few large pine trees growing in it. He stated that there is hardly a day during which he does not see a number of Sandhill Cranes and at times he passes very near them in his car. He stated that at this time of the year, and in the winter, they fed on the new grass as it sprouted in the freshly burned, open pine flats. He evidently knows the bird well, and his statements are to be relied on.

Before leaving the Leavells, Mr. Leavell very kindly agreed to interview other people living in this section of Mississippi, in an effort to gather additional data on the distribution of Sandhill Cranes in this section. Mrs. Leavell kindly undertook to send me the information. Under date of April 9, 1938, Mrs. Leavell writes: "Wilson Noble, one of our neighbors, is engaged in cutting the timber on the land on which is located Bear Pond, which you visited on Friday, April 8th. [It was in this pond that I saw the nest of the Sandhill Crane containing eggs and the two old birds.] Wilson states that last year he saw three crane nests, each containing two eggs; one was the nest which you saw, another about one mile west, and a third nest a short distance north of the place where you left the automobile when you visited the first nest. This last nest is located in the Little Bear Pond, the place you visited being the Big Bear Pond. Wilson says that he has not seen any of these nests this year, but is sure that they are there as he daily sees the birds come and go from these locations. He states that there is another nesting place east at a spot called the Ben Williams Swamp. For identification, this swamp is located southeast of John King's house about a half mile. [John King lives two and a half miles north of Fontainebleau Farm.] Wilson further says that last winter, probably December or January, he was driving down one of the side roads and a flock of cranes flew out of the grass just ahead of him and that he counted twenty-five birds in this one flock. This was near Ben Williams Swamp. On numerous occasions he has seen eight or ten together.

"Wilson manifests considerable interest in the preservation of the birds and promises to do all that he can to prevent them from being disturbed. Wilson Noble and Ernest Carroll are the only local people who have the full story, and each has promised to report to Mr. H. P. Flateau any developments or further information."

Under date of April 15, 1938, Mrs. Leavell writes me as follows: "Mr. Flateau, Jim [Mr. Leavell], and I took a short trip today in search of cranes and crane information. It is reported to us that about five miles due north of Ocean Springs there is a large flock of Sandhill Cranes, so we journeyed



FLORIDA CRANE IN FLIGHT

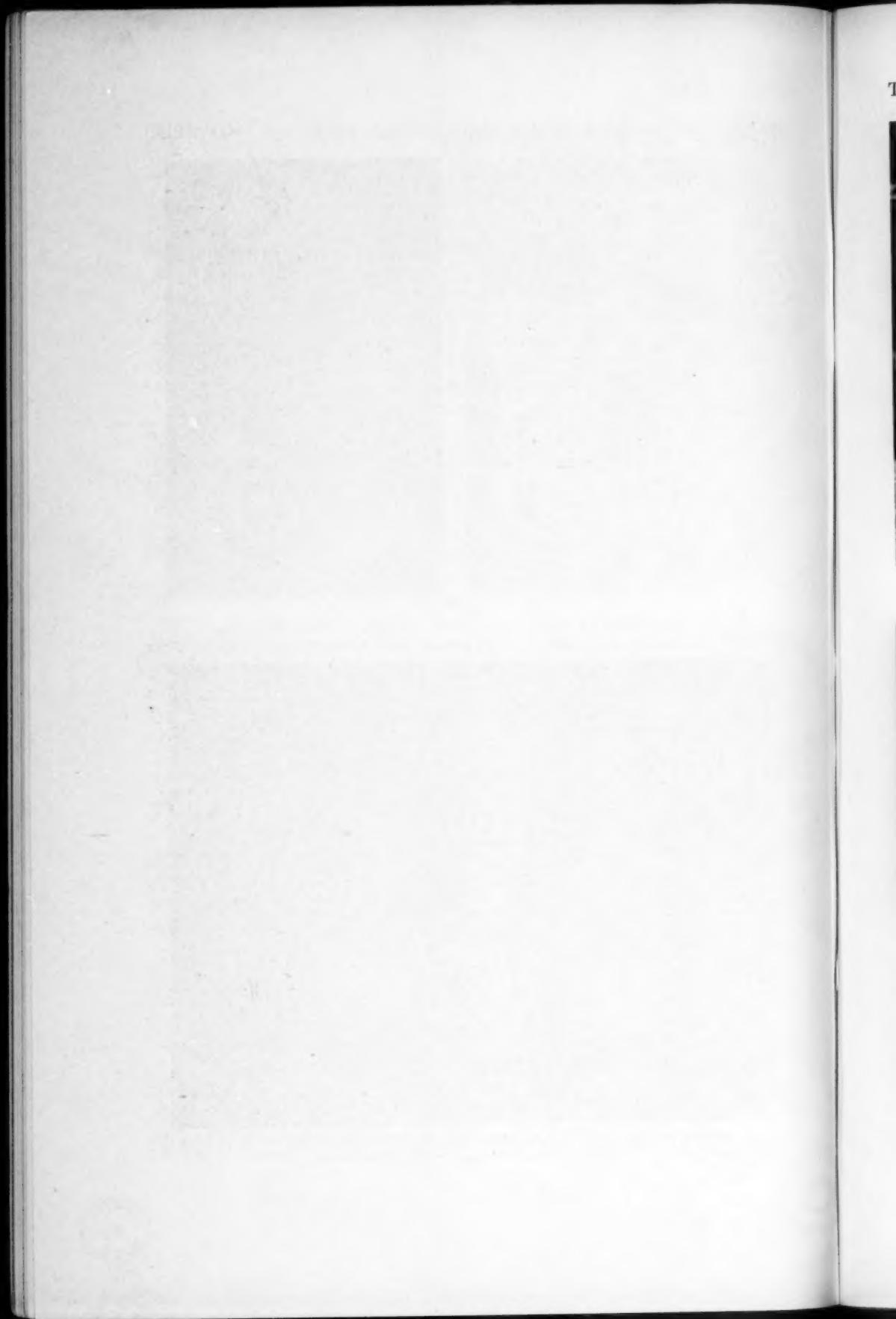


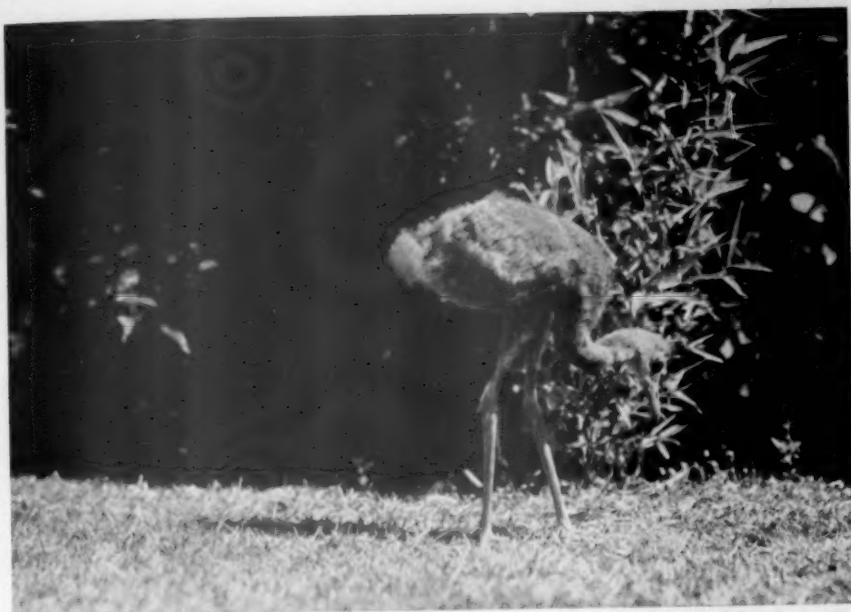
CHICK THREE DAYS OLD



NEST OF FLORIDA CRANE IN MISSISSIPPI





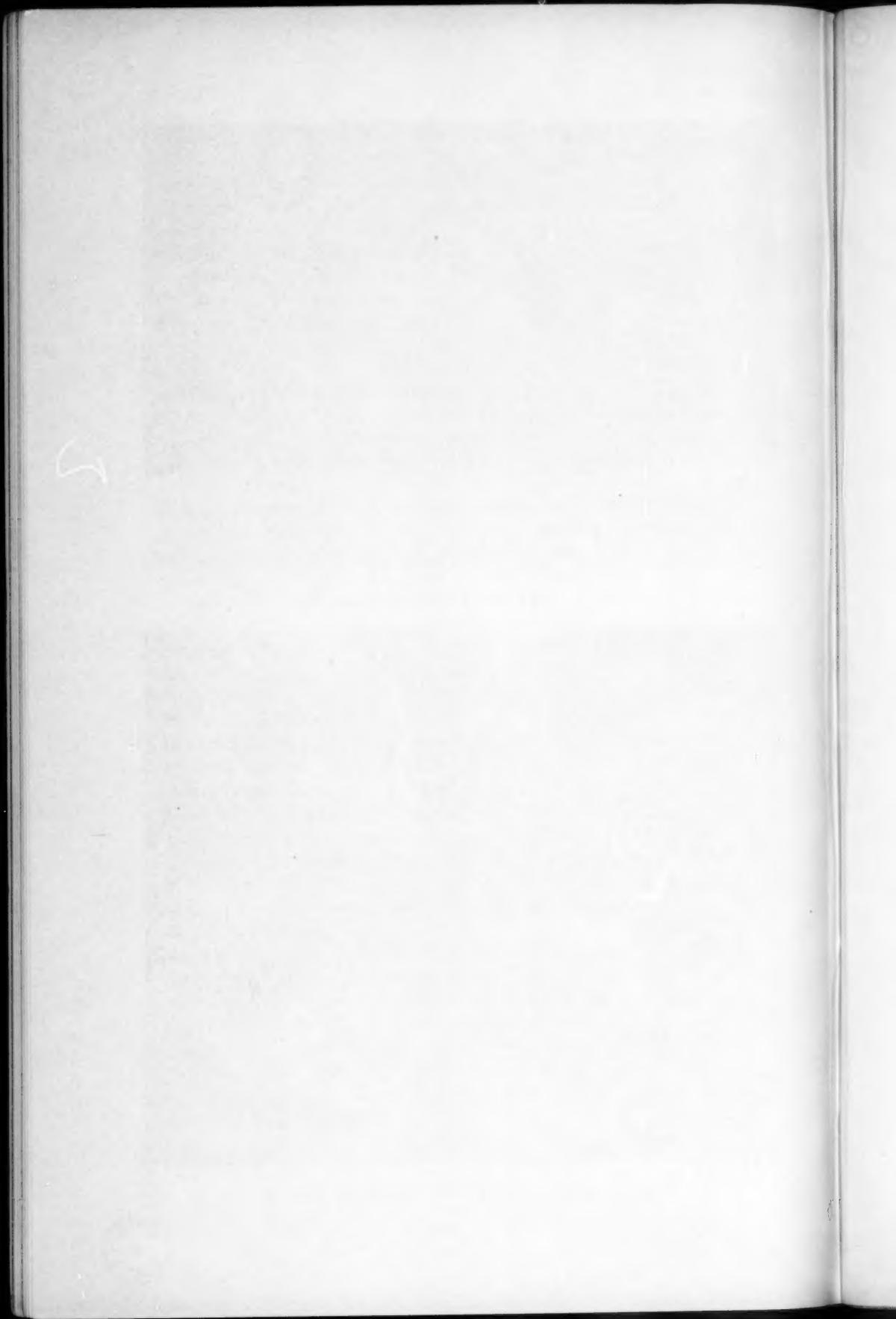


YOUNG FLORIDA CRANE THIRTY-NINE DAYS OLD



YOUNG FLORIDA CRANES AT SIXTY-ONE AND SIXTY-SIX DAYS





there. We found no cranes, but Mr. Flateau had an interesting conversation with Mr. Cox and Mr. Harding, both residents of that community. They each advise that there are quite a number in their community and that they have seen recently as many as nine in a flock. Mr. Cox appears to be an educated man and interested in bird life. He says he thinks he knows where some are nesting as he sees the cranes each morning and evening near his house. The location of this flock is about ten miles west of the Bear Pond cranes."

Under date of April 22, 1938, Mr. H. P. Flateau writes me: "I am pleased to give you further information on the cranes. Last Sunday, April 22d, I sent Ernest Carroll out on an all-day exploration to what is known as Crane Meadow. This is about two miles due east of Bear Pond. Ernest watched six pair practically all day, but was unable to locate any nests. There is another resident here by the name of Emile Ladnier, who has been getting some posts out for me at a location about two miles northeast of Crane Meadow. This section is known as Bayou Castelle. Ladnier and Donald Martin, on Tuesday, April 19th, counted thirty-four cranes in one flock. Yesterday, April 21st, he reports finding a nest with two eggs in same. Sunday, I am sending Ernest and Emile to make a thorough inspection of which I will report later of the findings.

"I believe you and Mr. Leavell talked to John King, the man who works for me at the house, about cranes. John sees cranes practically every day going over his house and believes there is another colony near same."

Under date of May 4, 1938, Mr. H. P. Flateau writes as follows: "I am pleased to give you further information on the cranes. Ernest discovered and has located three different crane nests, one with two eggs, one with three, and one in the process of building. On this same expedition he watched six different cranes. This is in the Bayou Castelle district. Sunday, he and John King (the latter works at the place and is the man you and Mr. Leavell interviewed) went on what we will designate the Ernest Williams' location, and there found six different nests. These all seemed to be old nests with the exception of two. One pair of cranes would not leave, so after searching, they found one young crane on the ground. Emile Ladnier has located a nest with two eggs. Location of this nest is about half-way between the Bear Pond and Bayou Castelle.

"I checked up on the Cox Harding location last Sunday. They advised if I had been an hour earlier they could have shown me three cranes. I met Mr. Cox in town last Tuesday and he said on Sunday afternoon, as well as Monday and Tuesday, the same cranes that he had been seeing, were feeding each morning and night on his place.

"I am sorry to report that the nest at the Bear Pond has been destroyed, or rather, the eggs are gone."

In an attempt to check a little more accurately the number of nesting Florida Cranes in this locality, my friends at Pointe aux Chènes spent a number of days during late April and early May in the field and located eleven occupied nests of this fine bird. All of the nests contained two eggs except one; this nest contained three eggs, one of which seemed smaller than the two others, and was not so dark in color. All of the nests located were built of small sticks, twigs and dry grass, into mounds from twelve to eighteen inches high, concave at the top and lightly lined with dry grass. All except one nest were built in wet locations, where there was some, and often considerable, standing water around them, in areas which had been either cut off or burned off some years before, and which were thinly covered with stumps and second growth. The one nest not in water was on dry land, in which a slight hollow had been scooped out and lined with dry grass.

Sad to relate in the territory where these cranes nested, on Thursday, May 12, in the space of two hours, there was a rainfall of between six and seven inches with a wind velocity of from sixty to seventy miles an hour. The wind and rain destroyed every one of the crane nests under observation. After the storm, when the nest containing three eggs was visited, two little cranes were found dead in the nest. The light-colored egg did not hatch, and on being broken was found to be addled. In two other nests young birds were found dead; in one nest one young bird just hatched was dead and the other egg partly covered with water was observed to be pipped and the chick alive. It was placed under a hen, and is now a strong, healthy youngster. A little crane four or five days old was found deserted by its parents and almost dead from exposure. It also was taken in, and is now strong and beginning to feather (see Plate 22, showing these young at later stages).

From the evidence gathered, it is quite definite there exists a considerable resident breeding colony of Florida Cranes in the wet lands of southeastern Mississippi. In all probability, it has been there from prehistoric times, and its numbers are not decreasing. How this considerable colony of large and rare birds could have passed unnoticed and unrecorded by naturalists until now, is a mystery.

Avery Island, Louisiana

SEASONAL VARIATIONS IN THE TREE SPARROW¹

BY A. MARGUERITE BAUMGARTNER

Plate 23

In addition to the general characteristics of structure, size, and plumage of a given species, certain changes may be observed from season to season, as in the feather wear, weight, or gonads. In this study of the Tree Sparrow (*Spizella arborea arborea*), except for the description of molt which will be treated in full, only full-grown birds will be discussed. The growth of the nestling, development of feather tracts, etc., are a chapter in themselves and must be presented elsewhere. The following observations are based on specimens collected at Ithaca, New York, from October through April, and at Churchill, Manitoba, during June, July, and August.

MOLT

The most concise statement of molt in the Tree Sparrow is that given by Dwight (1900), and in the following discussion his summary, in quotation marks, will precede such additions as I have been able to make. Colors refer, as far as possible, to Ridgway's (1912) standard nomenclature.

The molts of the sexes of *Spizella arborea* are alike, as would be expected in birds of similar plumage. This species is classed by Dwight among those birds: 'I. which have an annual or single molt (Postnuptial); A. in which the postjuvenile molt is incomplete, not involving remiges nor rectrices; 1. in which young and adults are nearly alike in winter and nuptial plumages.' Plumage sequence is as follows:

(1) *Natal down*.—"No specimens seen" (Dwight). The Churchill nestlings, hatching in early July, were sparsely tufted with fuscous down. This plumage was of short duration, and at the time the young left the nest at the age of about nine days, only a loose fuzz remained, clinging to the tips of the superciliary feathers like elongated eyebrows.

(2) *Juvenal plumage*.—"Acquired by complete postnatal molt." This plumage I would subdivide into two phases on the basis of the dorsal feathers; for even before the birds are full grown and before any other region is affected, there is a gradual invasion of adult feathers in this area, with the result that full-grown birds still essentially juvenal have an altogether different appearance dorsally from young just out of the nest. This conclusion is based on observations at the nest and the preparation and study of thirty-eight specimens.

(a) *Fledgling*: from the time the bird is completely feathered (about eight days) until nearly full grown (about four weeks). Birds of known

¹ Submitted as part of a doctorate thesis at Cornell University, 1935.

age up to 23 or 24 days on July 26 were entirely juvenal; after August 1, only one unusually small individual can be considered as phase *a* (Plate 23, upper figure, two birds at left).

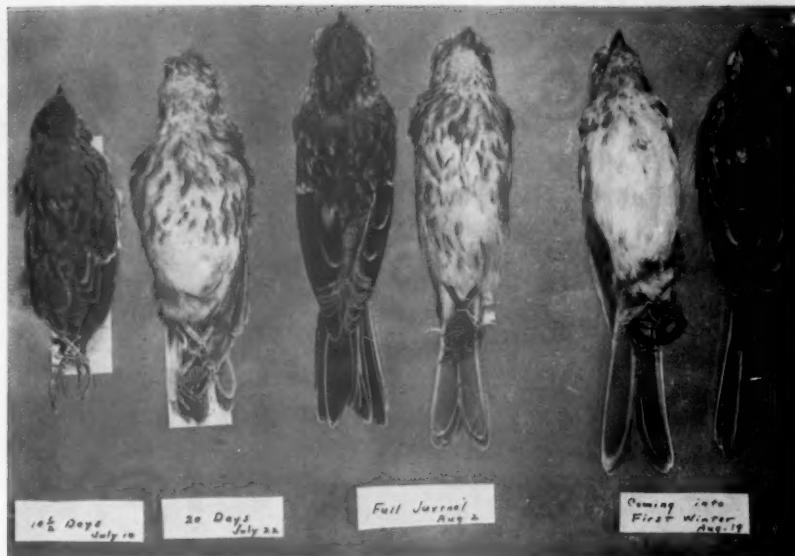
Description: Pileum dull cinnamon brown, streaked by the black shafts of individual feathers, and more or less edged with light buff; nape similar, the black shafts indistinct or lacking, becoming grayer or buffier on sides of neck; feathers of back and scapulars broadly centered with black, edged with light buff and occasional touches of chestnut, especially the latter; rump and upper tail-coverts light buff, indistinctly streaked or mottled with black; sides of head and whole under parts light buff (shading to light smoke gray on throat and becoming a rich buff on sides), heavily streaked with soft black, especially on the breast, but not on lower abdomen and under tail-coverts.

Except for the heavy streaking on the breast the color pattern is essentially like that of the adult plumage, with the distinct pileum color terminated by a grayer nape, the broadly streaked back and rich buff of the sides. The same facial expression is produced by a light superciliary stripe, an irregular dark line under the eye and a definite postocular streak. The dark pectoral spot, contrary to Beebe's assertion (1907), can be identified from among the heavy streakings of the breast. A small patch of dull chestnut at the bend of the wing is streaked with black in this phase of the juvenal plumage. The wings and tail are, of course, those of the first winter.

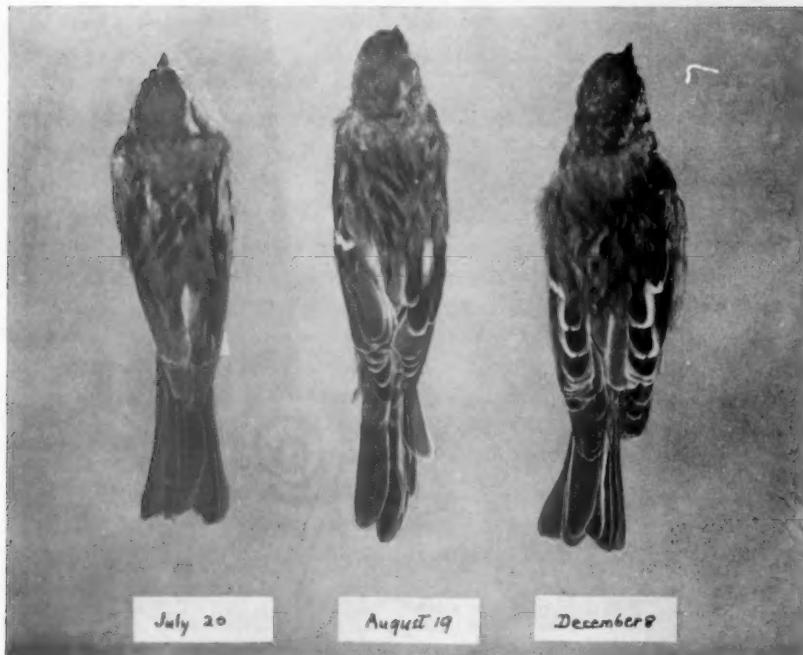
(b) *Full-grown juvenal*: transition stage from the time the first adult feathers appear until the more general molt (Plate 23, upper figure, two birds in center). At Churchill this phase was found during the first two weeks of August, when the young were practically full grown. Upon skinning, heavy rows of stubby sheaths were revealed in various parts of the body. The backs showed varying amounts of the rich chestnut-edged feathers of winter, and the streaked chestnut patch at the bend of the wing was early replaced by true adult feathers. After the middle of the month, the adult plumage rapidly replaced the juvenal and the birds passed into the next stage. Nelson (1887) states that in Alaska, full-fledged young were taken in mid-July or earlier, and that by the first of August, fall plumage had been assumed by nearly all, young and adults.

(3) *First winter plumage*.—"Acquired by a partial post-juvenal molt in August which involves body plumage but apparently not the wings or tail, young and old becoming indistinguishable." This molt, as just stated, has begun on the back and side patch before the young are full grown, about the first of August, but does not reach its culmination until after the middle of the month (Plate 23, upper figure, two birds at right).

The sequence of molt in the feather tracts is more or less irregular, with fresh quills appearing early in one individual which in another may not

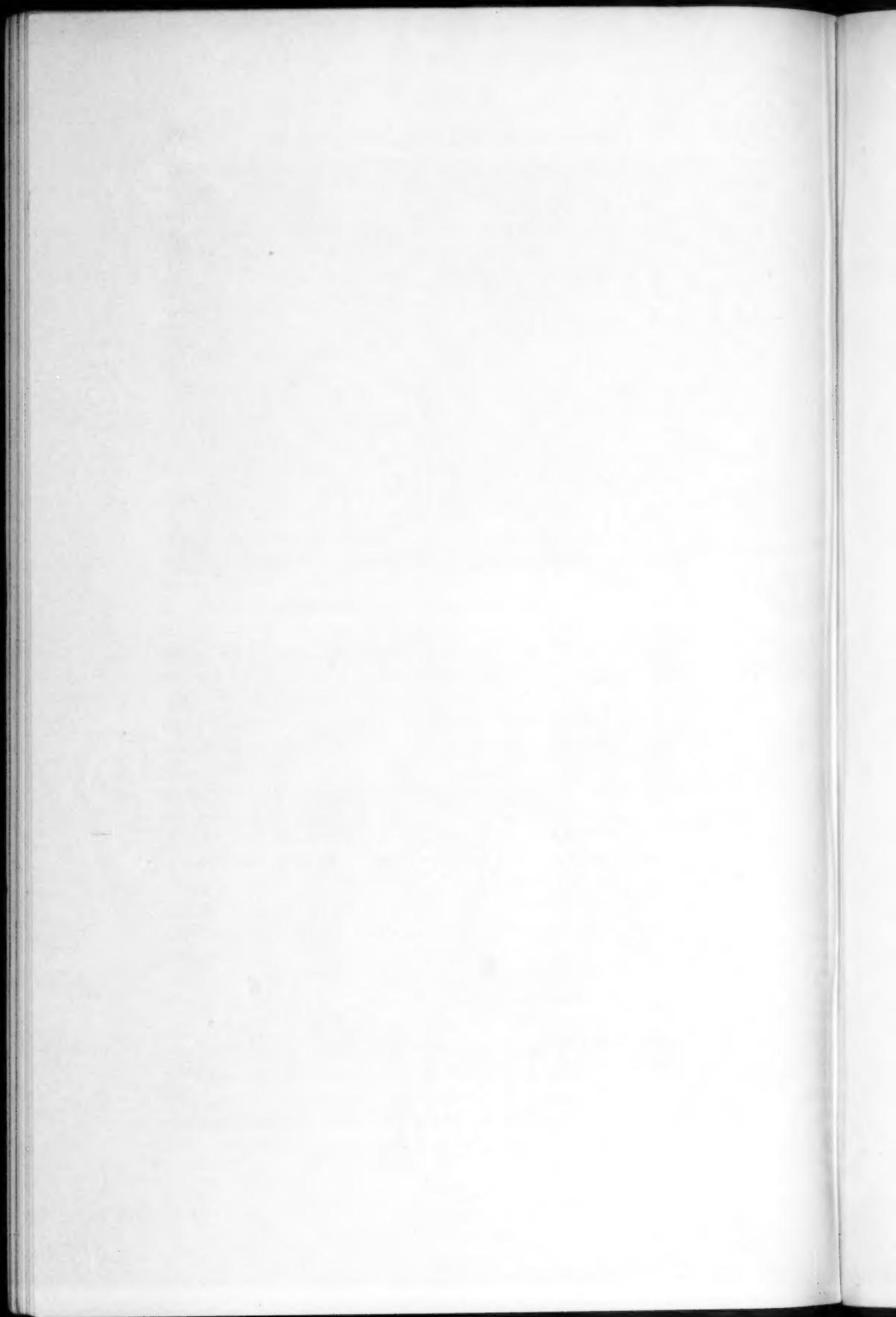


PLUMAGE DEVELOPMENT IN YOUNG TREE SPARROWS



PLUMAGE DEVELOPMENT IN ADULT TREE SPARROWS





develop until near the end of the molt. One of the areas that regularly makes an early appearance is the wood brown of the sides, which at first has a decidedly pinkish cast and makes conspicuous blotches among the soft streaky feathers of the juvenal under parts. The first chestnut feathers of the pileum usually appear at the base of the bill or over the eye, developing in cephalocaudal sequence. Except in one specimen (August 2) none shows this development until after the middle of the month, when the back and sides are well feathered and other tracts are in heavy quills. The last juvenal feathers to disappear are those of the nape, the dark postocular stripe, and scattered streaky feathers of the throat and breast. None of the birds collected up to August 19 was in complete winter dress, and feet and bills were still somewhat pale.

When the species arrived in Ithaca in the fall, traces of the molt could still be discerned in ten per cent of those collected, of which three were young birds. An adult female, on October 31, showed pronounced sheaths on the inner row of the ventral tract. A few sheaths were found on the nape and throat in another on November 4, in a male on November 16. This and succeeding plumages have been fully described by numerous authors, so that repetition is unnecessary.

(4) *First nuptial plumage*.—"Acquired by wear, the buffy edgings of the back becoming grayish and the chestnut everywhere slightly paler" (this and ensuing paragraphs pertain, of course, to first-year and adult birds alike). A series of skins chronologically arranged, shows a gradual but definite change through the year, becoming more pronounced after the first of March. A certain amount of this is due to fading, as Dwight intimates, but the chief cause is actual wearing off of the feather edges.

In Table 1, on page 607, an attempt has been made to trace this development by describing representative stages at which the changes become conspicuous. Plate 23, lower figure, shows birds (from left to right) in late summer plumage, during postnuptial molt, and in early winter plumage.

During the spring there is in addition a restricted molt of which Dwight says: "New feathers regularly grow on the chin in March but apparently not in the other tracts and their appearance indicates, as in some other species, renewal rather than molt, for they are very few in number." This was first observed in three of twenty-three specimens on February 26, 1935, and became universal throughout March and April in both sexes. It was found, however, to be more extensive than is usually accredited this species, for of 130 specimens examined, fresh sheaths were evident regularly on *checks*, *chin*, later on the *throat*, and other tracts were affected in the following proportions (in this count scattered feathers were not considered, but only definite areas of new quills):

<i>Tract</i>	<i>No. of specimens showing molt</i>
Crown (sides and back only)	5
Superciliary stripe	6
Lores	3
Nape	10
Dorsal tract	19
Scapulars	4
Rump	2
Sides	5
Belly	6

(5) *Adult winter plumage*.—"Acquired by a complete postnuptial molt, indistinguishable from first winter dress." At Churchill, Manitoba, the first evidences of this plumage were detected on July 31, 1933, and on August 3, 1934. The sequence is again irregular, varying in different individuals, but in general it appears that the contour feathers somewhat precede the flight feathers, and progress more or less from the anal region cephalad. Thus the specimen on August 3 showed stubby quills in the lower ventral tract and the upper and under tail-coverts; but it also had one new sheath in the tail and several on the wing-coverts. An August 5 bird, still more contrary to rule, showed no molt except in the primaries. On August 19, however, seven specimens were in almost complete winter dress caudally, with the remnants of sheaths at the base only; heads were in every stage of molt, proceeding from the bill backward; napes were all excessively worn and bristling with new sheaths; while among the flight feathers the tails were incomplete, varying from only two feathers and short quills, to those in which the innermost were completely grown, the marginal ones half-grown; and wings showed only two or three central primaries and secondaries in sheaths.

During the early fall migration four specimens (five per cent of those collected) showed fresh sheaths. In one, the inner row of the ventral tract was in heavy molt; in the others it was restricted to small patches on cheeks, chin, crown and rump. Whether this should be considered the last of the postnuptial molt or simply feather renewal is uncertain.

(6) *Adult nuptial plumage*.—"Acquired by wear as in the young bird."

FEATHER RENEWAL

Besides the regular molt, the bird has the capacity to replace feathers that have been lost. Tail-feathers and even the whole tail are lost rather easily. Several cases were observed at the banding station and twice in the field. Miss Aslop (1926) notes that in a Tree Sparrow that had lost its tail at her station, new feathers came in irregularly, growing out and then being lost again. Miss Thorp (1929) gives a detailed record of the plumage re-

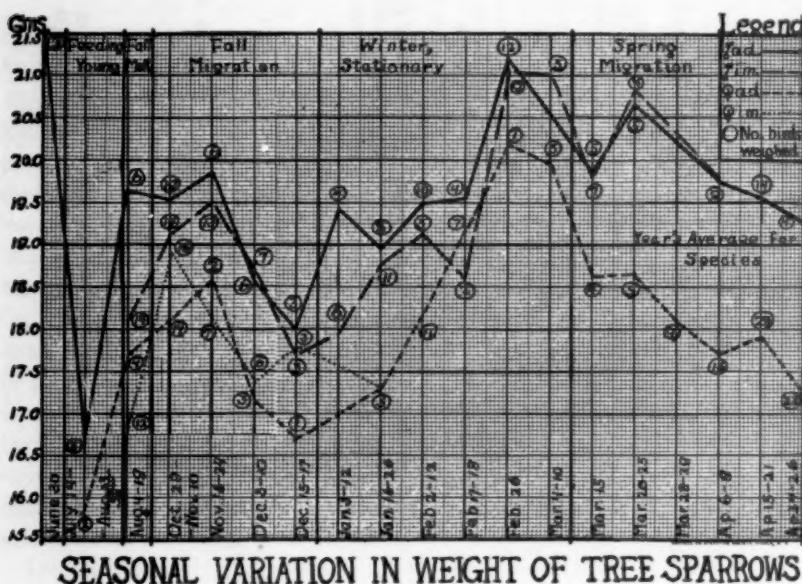
TABLE I
Development of Feather Wear

	November 1 (Fresh winter plumage)	March 1 (End of winter)	May 1 (Last migrants)	June 1 (Pre-breeding)	August 1 (Pre-molting)
Crown	Chestnut; veiling more or less heavy	Beginning to wear	Veiling almost gone	Veil gone; feathers have frayed appearance	Faded to hazel; feathers badly worn and many lost
Nape	Rich chestnut wash		Wash slightly faded and worn	Wash almost gone	Wash completely gone, very worn and gray
Back and Scapulars					
a. Buffy edgings	Broad edgings	Slightly worn	Worn	Much worn, only narrow edging black, back dark	Almost gone, leaving back largely black and very frayed
b. Chestnut edgings	Broad edgings	More worn	Much worn	Almost gone on back, much worn on scapulars	Practically all gone except faded remnant on scapulars
Wings, outer web:					
a. Primaries	Blackish brown	Somewhat faded and worn	Edges slightly worn	?	Faded to clove brown and badly worn; edgings badly faded, covers lost
b. Secondaries	Edged whitish		Faded to buffy or hazel		
c. Tertiaries	Edged chestnut (narrowly) Edged chestnut (broadly)				
Tail	Blackish brown; outer edge and tip broadly edged with whitish	Somewhat worn	Faded, more worn	Badly worn	Faded to clove brown, frayed and broken, outer webs worn com- pletely off, 3-10 mm. of length lost
Under parts					
	Pale buff, grayer on throat, sides pale wood brown	Slight and very gradual wear	Slight and very gradual wear	Slight and very gradual wear	Badly worn, very gray and ragged, sides faded to dirty buff

newal of a bird wounded in one of her traps. A gash from bill to crown, that laid bare the skull, required seventeen days before the skin was replaced and quills began to appear, and about a month before the bird was indistinguishable from the others.

WEIGHT

Correlation with life cycle.—Kendeigh (1934) states that passerine species are generally heavier in winter, presumably due to three factors: freedom from the cares of reproduction, freedom from the exhaustive process of molt,



TEXT-FIG. 1

and physiological changes accompanying changes in climatic environment. Weights of the Tree Sparrow at different seasons follow a curve that can be closely correlated with the bird's activities. The accompanying graph (Text-fig. 1) has been prepared from averages of 455 specimens collected from June 30 to August 19, at Churchill, Manitoba, and from October 29 to April 26, at Ithaca, New York. The figures in circles indicate the number of birds upon which each average weight is based. First-year birds have been given separate rank as long as they could be distinguished by skull or gonadal differences. All birds were weighed within a few hours of collection.

A study of these curves shows an abrupt loss of weight with the advent of young birds in early July, followed by an almost equal increase after the fledglings can take care of themselves and preparations for the fall migration have been initiated. No records were obtained from August 19 until the arrival of the species in Ithaca at the end of October; in this interval the young had attained practically adult proportions. Immature males average somewhat lighter than adult males, but young females seem slightly to exceed the adults of their sex. Whether the low averages from December 15 to 17 are due to an inaccuracy of the scales or to an influx of late migrants worn down by the vicissitudes of travel, is uncertain. A more or less uniform weight is maintained throughout the winter months, culminating in a sudden increase at about the end of February, after which there is a gradual decrease during the spring migration. L. E. Hicks (in litteris) collecting in Ohio during March, 1935, sends me figures very close to my own, but with a slight increase up to April 2, the last date of collecting. In both sexes the maximum figures for the year, both of averages and of individual high points, are attained in late February. Minima occur in July when both parents are feeding the young, although a few individuals approximate these low figures in late April.

Figures for the year are given in the following table (Table 2). In order to assure equal emphasis upon all periods of the year rather than upon days of heaviest collecting, these averages were compiled from the averages for each bi-weekly period. The average for the species is that of the four yearly averages.

TABLE 2
Yearly Average and Extreme Weights of Tree Sparrows

	Average	Maximum	Minimum
Male adult.....	19.47 grams	22.7 grams	15.9 grams
Male first year.....	19.28	22.6	15.3
Female adult.....	18.62	20.7	15.0
Female first year.....	18.85	20.0	15.3
Species average.....	19.05 grams		

Comparison with birds at feeding stations.—Weights of forty-three birds at the feeding station during February and March of 1933, tended to range somewhat higher, doubtless due to full crops at the time of weighing, if not also to more sheltered conditions of the marsh near human aid. The average for the species here was 22.0 grams, with extremes of 24.4 and 19.0 grams.

Loss in weight of dead birds.—In order to check the value of second- and third-day weights on collected specimens, a few birds were weighed every evening over a week's time, with these results:

TABLE 3
Loss in Weight of Dead Specimens

	Loss first day	Loss in 7 days
Two specimens in cooler.....	0.4 gm.—01.90% 0.3 gm.—01.65%	0.7 gm.—03.33% 0.6 gm.—03.29%
One specimen in room temperature.....	0.5 gm.—02.76%	

FAT CONTENT

Correlated with weight is the amount of fat encircling the body. While no pronounced change could be traced through the winter months due to the range of individual variation, there was a marked difference between winter and summer birds. Fat tracts were still well developed in specimens of the first week of June before breeding activities had begun, but the few birds collected during the nesting period were extremely lean. Fat was not observed again until August 8, when family cares were practically over. In juvenal birds it was first observed on August 1, in a fully fledged young.

On a well-padded specimen of March 20, 1935, the fat was scraped off as clean as possible and found to weigh approximately 1.5 grams, or 7.73 per cent of the total weight. The animal is not, as Beal (1925) extravagantly says, equipped with "a set of underflannels from $\frac{1}{6}$ to $\frac{1}{4}$ inch thick all over the bird's body" after the fashion of ducks and shorebirds. Rather fat is found in well-defined patches corresponding to the feather tracts, encircling the neck and upper breast, and especially on the lower belly and anal region.

SIZE OF STOMACH

Allen (1909) shows the change in width of stomach muscles of the Red-winged Blackbird with the change from granivorous to insectivorous diet in summer. A like development was noted between winter and summer Tree Sparrows, although no notes were taken on the subject. The width of the stomach muscle during winter is approximately 5-6 mm.

DEVELOPMENT OF SKULL

The juvenal birds of mid-August displayed uniformly unossified skulls. Upon the arrival of the species in Ithaca in late October, birds of the year could readily be identified by the large pellucid area of the parietal bones, although the floor and back of the brain case and all the occipital and mandibular regions were fully ossified. Gradually this area was invaded by the denser osseous tissue, working forward in a more or less regular pattern until in mid-December and early January, at the age of about six months, only a thin line remained, usually directly behind the occipital crest.

On January 16, six males still showed vestiges of the clear area, while two whose testes were distinctly immature, were indistinguishable from adults by skull characters. On the 26th two were incompletely, three completely ossified. The latest trace was found on February 2, 1935.

DEVELOPMENT OF GONADS

Three characters were traced in the seasonal changes of the gonads: size, color, and histological structure. With the generous advice and assistance of Dr. B. F. Kingsbury of the Cornell Histology Department, a series of over one hundred winter testes and ovaries was stained and sectioned, in the hope of detecting differences between adult and first-year birds in winter after other characters had failed. While results have not been entirely satisfactory in this connection, it was interesting to watch development with the approach of spring.

Juvenile birds.—Although young birds had attained their full size by the first of August, genital organs could not be detected with the unaided eye until August 17, at the age of about six weeks. Males evidently develop earlier than females, as indicated by the following table (sex based on measurements).

TABLE 4
Development of Sex Organs in Juvenile Tree Sparrows

(14 birds collected August 17-19, 1934, at Churchill, Manitoba)

Presence of:	In males	In females
Gland and duct.....	5 birds	1 bird
Duct only.....	1 bird	4 birds
Neither.....	0	3 (?)

Male.—The testes at first appearance were about half a millimeter in diameter and of a delicate translucent white. Fall testes of first-year birds (end of October) measured 0.8 mm. as compared with the buffy adult glands twice that size. No change could be detected through the winter until mid-February, when a few evinced a slight swelling; whiter testes measured the same as buffy ones so that age could no longer be declared with certainty. The smaller size still obtained for the majority, however, until March 15, and for one as late as March 28. The last spring testes ranged from 2.0 to 2.6 mm. in diameter.

By the first week in June at Churchill, Manitoba, testes were well developed and many of the birds were already breeding. In specimens collected on the 4th and 5th they ranged from 6 mm. to the full size of about 10 mm., buffy, more or less kidney-shaped organs on the surface of which could be discerned the fine reticulations of the tubules. Testes were still slightly enlarged on July 23.

Cross-sections of the testes of November birds which were known to be adult displayed a conspicuous shrinkage of the tubules from the basement membrane. While immature specimens studied were not shrunken, Dr. Kingsbury considers this a not wholly reliable characteristic of immaturity. In addition to this, the basement membrane and interstitial epithelium seemed to be less dense in first-year birds. By mid-February the swelling in size above noted was accompanied by the swelling of the tubules and rapid proliferation of new epithelium, so that it became increasingly more difficult to distinguish adults from birds in their first winter. By April, it was impossible even to hazard a guess at their age. Other characters that have escaped my attention may prove more permanent criteria, but considerably more study will be necessary before final conclusions can be drawn.

Female.—As just stated, the female organs developed later than those of the male, for only the beginning of an ovary was observed in one specimen on August 19, the last date of collecting at Churchill. By the end of October, however, the ovaries of young and old were indistinguishable in size, color, or shape. Whitish, flat, roughly triangular and finely granular in texture, they were about 3 mm. in length. After March 15, they began to appear more rounded and granular, attaining a maximum length of 4 or 5 mm. before the spring departure.

On June 4, a female collected in company with a fully developed male had ovaries only slightly developed, with individual ova only 1 or 2 mm. in diameter. The laying period followed from one to two and a quarter weeks later. On June 26, a bird taken on the nest contained in the oviduct a fully formed egg. The ovary held several other ova in which the yolk had begun to be deposited, ranging from 4 or 5 mm. to minute size. The reproductive organs in July were much reduced and by August had shrunk to winter dimensions.

Histological specimens showed little difference between adult and first-year birds. Follicle scars could sometimes be noted in the fall, indicating previous breeding, and it may be that further study of this material will reveal other characters.

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1929. The case of Tree Sparrow No. A126302. Bull. Northeastern Birdbanding Assn., 5: 120.

EXPLANATION OF PLATE 23

DEVELOPMENT OF PLUMAGE IN TREE SPARROWS

UPPER FIGURE: young Tree Sparrows. Two specimens at the left, **fledglings**; two in the center, full-grown juvenals; two at the right, molting into first winter plumage.

LOWER FIGURE: adult Tree Sparrows. At the left, worn breeding plumage; center, postnuptial molt; at the right, early winter plumage.

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INSTINCTIVE MUSIC

BY SYDNEY E. INGRAHAM

Plates 24, 25

IN recent years a very fine piece of work has been carried on by Mr. Albert Brand and Professor Arthur A. Allen of Cornell University, and their associates, in photographing the songs of wild birds. A few years ago Mr. Brand published in 'The Auk' (52: 40-52, 1935) an article entitled 'A Method for the Intensive Study of Bird Song,' in which he described how he counted the frequencies of the notes on his sound films in order to determine their pitch. At the time he wanted to find out the range of pitch in bird notes, and he gave tables showing the highest frequencies in thirty-five different songs. He also showed some interesting graphs of the songs, but in these he had recorded the pitch only rather roughly with reference to our own musical scale, and without considering the length of notes and stops. As we are by no means certain that birds sing according to our musical scale, it occurred to me that it would be worth while, from the point of view of musical theory, to make some microscopic transcriptions of a few of the more musical bird songs, with the pitch, the relative intervals, the rhythm and the dynamics shown to the eye precisely as they were sung, without any, or at least without too much reference to our own system of instrumental tuning and musical notation.

Mr. Brand has also published two books entitled, 'Songs of Wild Birds' and 'More Songs of Wild Birds' which contain in their cover-flaps sets of small victrola records made from his sound films. He very generously gave me permission to transcribe songs from these records by any method that I could devise, and kindly sent me a set of his original films, with samples of the songs of about a dozen birds. Lately I have received another box-full, with fourteen different songs. Of course, only a few can be reproduced here.

I set to work, not at first on the films, but on one of the victrola records, because the songs of the records were longer and musically more nearly complete. My time unit for counting on the victrola record was 1/100th of a second. Calculating according to the speed of the victrola turntable, I had radial lines traced on the record, dividing the circle into, roughly, seventy-seven small segments, each with a musical time value of 1/100th of a second. On the films my unit was 1/96th of a second, because there are very convenient sprocket-holes cut close together along the edges of all sound films, and it is easily calculated from the speed of exposure that the space from one sprocket-hole to the next on a 35-millimeter film has a time value of 1/96th of a second. Before beginning, I examined the sound

films sent me by Mr. Brand and I could tell at once that in some respects the films were much richer material than the victrola records—there was more recording of overtones, especially in the songs of the larger birds. As the overtones determine the quality of the tone of a note, there was more *Klangfarbe*, as the Germans call it, on the films. A perfect scientific guide to bird song ought to contain microphotographs showing characteristic sound waves of certain bird notes with their overtones, then we could take a long look at the throaty quality of the note of the Yellow-billed Cuckoo, or at the wheezy tone of the Black-throated Blue Warbler. And possibly, in the future, if someone were to make a specialized study of the sound films of birds and other animals, new instruments might be devised with special overtone combinations which would add all kinds of amusing natural effects to our orchestras.

The development of sound photography is so recent that relatively few intensive transcriptions of sound films have yet been made. If I seem to stress the significance of the overtones in the following study, I may have been influenced partly by the mere use of a powerful microscope on sound film, because one cannot look at the rhythmical and complex patterns of sound waves, week after week, month after month, without a growing conviction that there must be still a great deal to be learned musically as well as scientifically about overtones; they are the chief revelation of this new branch of extra-sensory technique. Under the microscope one can see that they are not always produced quite simultaneously with the fundamental. It often happens that their number is likely to increase as the sound of the fundamental is dying away, and this slight lag in time may account for our subjective awareness of them, not only as haphazard tonal combinations, but in their true order as a natural musical scale, in relation to each other.

EXPLANATION OF THE CHARTS

Although the frequency numbers of musical intervals advance geometrically, doubling with every octave, we are used to even-sized octaves, so I chose semi-logarithmic paper for my charts. The lines on this paper are not evenly spaced; they are ruled gradually closer and closer together as they rise, in such a way that the distance between 2 and 4 is the same as the distance between 3 and 6, 4 and 8, etc., so that the space up and down represents an even and constant rise in pitch as we seem to sense it, with equal spaces for each higher octave.

The reason why we are used to even-sized octaves is quite curious and revealing for it goes to the root of music. Our musical perception of the ratios of sound waves controls our sense of pitch and is connected also with the automatic capacity for modulation or transposition that we seem to

share with birds, a capacity for shifting the tonality of one or more intervals so that the harmony centers upon a new keynote. The best explanation would seem to be, with reservations, the Weber-Fechner law, a famous psychological generalization, first stated by Weber, and later developed by Fechner. "In comparing objects," said Weber, "it is clear that we perceive not the actual difference between the two objects, but the ratio of this difference to the magnitudes of the two objects compared." If the stimuli from external objects are increasing in geometrical progression, the psychological series increase only in arithmetic progression. And when we have two series corresponding point by point, the one geometric and the other arithmetic, the mathematical relationship between the two must be a ratio or logarithmic one. Fechner developed this idea and formulated it as an equation.

Whatever the explanation, it is obvious that musically we do perceive not the actual frequency difference between two sound waves, but the ratio of the two frequencies. Here are two frequency intervals, 200-100, 774-387; we hear them both as octaves, the second pitched considerably higher than the first. Both are in the ratio of 2 to 1. A musical interval, then, is a ratio, so that the two words can be used here synonymously.

Semi-logarithmic paper is ratio paper and if we choose it for this work we are deliberately reproducing an automatic process of our sense of hearing and arranging the frequencies of bird song so that we see them on the graphs as we hear them, in a diminishing perspective of pitch. The original charts that I made are rather large. Unfortunately, when they are photographed for reproduction and reduced, the fine lines and close figures printed on the semi-logarithmic paper tend to disappear, so I have marked on the right-hand margins the diminishing intervals of the frequencies in thousands. But because we are so accustomed to the regular musical symbols, I have drawn on the left margins sections of our musical staff to scale, with large notes representing the common chord and showing the positions of C6 and C7 in our tuning. The diminishing ratios of the physical scale and the equal ratios of our own scale can then be easily compared. C7 is the last note on the piano; it is two octaves above the high C of a light soprano. In bird song it is a note of medium pitch and it occurs frequently.

On the graphs every frequency number is plotted just as the bird sang it, and it will be seen that there are a great many random notes in the songs that do not fit into any musical pattern. But occasionally a bird seems to be aiming deliberately at a musical ratio, and in that case I have drawn pencil lines on the graphs to show the position of some of the basic intervals, such as octaves, fifths or thirds, which belong both to the series of overtones and to our musical scale, and the eye can then easily judge whether the bird is singing them in tune or not. The tuning of pure overtones is very simple,

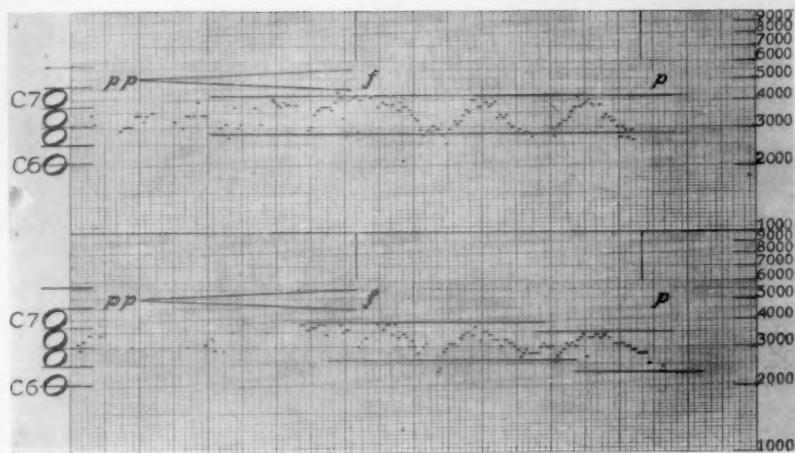


FIG. 1.—SONG OF THE VEERY

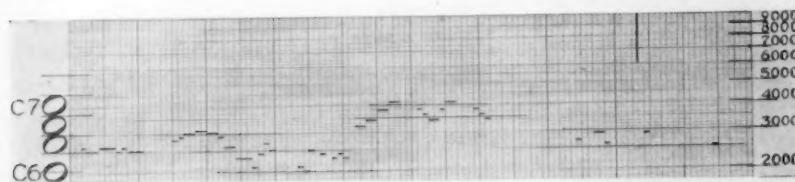


FIG. 2.—SONG OF THE OLIVE-BACKED THRUSH

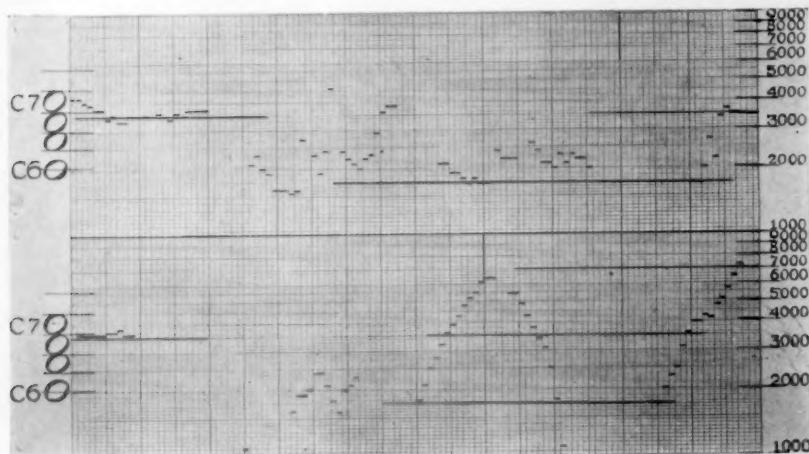


FIG. 3.—SONG OF THE BROWN THRASHER



in contrast to the complexities of our own logarithmic tuning. If we assume 2000 frequencies as a base note in a bird song, the octave, as in our scale, will be 4000. The pure fifth will be 3000. The notes of the common chord will be 2000, 2500, 3000 and 4000 and they can be very easily picked out by eye on the semi-logarithmic paper.

As to the timing of the charts: In the transcriptions from the victrola record, I plotted 1/100th of a second to each small square printed on the paper, except in the case of the Veery's song, which was so long that I used only half a square for each unit. Strong vertical lines drawn downward from the top of the charts mark the lapse of each second. In the case of transcriptions made from sound films, I plotted 1/96th of a second to each small square of the paper. I corrected this error of four per cent in pitch, not by changing all the frequency figures, but by changing the relative position of the note C as marked on the left-hand margin of the charts. On all the charts the lapse of a second is clearly shown by the strong downward line from the top, and that is the simplest time measure for the eye to follow.

At first, I had wondered whether I might not use our own musical notation as a frame work, but for various reasons I found it quite impractical. The tuning of our well-tempered scale is a matter of tedious calculations. Each rise of a semitone represents a ratio of 1.05946. In order to find a fifth, for instance, which is seven semitones higher than a given tonic, the frequency number of that tonic must be multiplied by $(1.05946)^7$. Then the spacing up and down on the musical staff does not correspond accurately to a constant rise in pitch; a half space represents here a whole tone, there a semitone.

VEERY

This song of the Veery (Pl. 24, fig. 1) is both simple and complex. There is a very simple musical phrase—like five-finger exercises played on a harp—which is repeated four times, but never exactly in the same way. On this victrola record, the beginning of the first phrase is interrupted and blotted out by a Robin's call, but by looking at the charts one can see that the three other repetitions all begin in the same way, with a soft tremolo, very irregular, teetering and pianissimo, that rises crescendo to a flattened fourth before it touches the loud pure fifth which is the dominating interval of the song. This introduction is half of the song; it takes one second, the whole two seconds. It is curious that there is usually no record of an introductory tremolo for the wildness and delicacy of such a gradual crescendo must add to the beauty of the Veery's song.

The second half of the song is the sort of thing we are more familiar with, and yet it is disappointing for it seems short and incomplete. There is the

waving, curling musical line typical of the Veery, a slurring upward and downward between fifths, but we usually expect four or five downward shifts. Here we see only two or three waves at the end of each phrase, with either one downward modulation of about a whole tone, or none at all.

The pitch of these fifths is usually 3900 over 2600 sharpening to 4000 over 2700, and modulating to 3500 over 2300 frequencies. However disappointing, the record at least makes it clear that a bird can have a musical ear, for there is no mistaking the Veery's intention, the pure fifths are repeated over and over again in the second half of each phrase. The interval is not a mere accident, as it might perhaps seem to be in the more irregular song of the Bobolink. Curiously enough, the flattened fourth is also repeated at the same point in each call, as if it were a habit. But the fifth is in tune and obviously forms the basic pattern of the song. Nor is it mere chance that there is a tendency to shift the pitch of the interval downward. The pattern of the Veery's song has been recorded by countless ornithologists in the field and there is always a tendency to downward modulation. Mathews writes it so.

Here is very good evidence to show that birds apprehend the relative pitch of sound waves according to their *ratios*, just as we do, and consequently share our instinctive faculty for making changes of tonality. In the article in 'The Auk,' to which I have already referred, Mr. Brand made a study of the Winter Wren's song, which is very brilliant and dazzling, and delivered at great speed. "Because of the great number of notes," he wrote, "in the Winter Wren's song (113 in all), it has been necessary to divide the graph in half. . . . Here an interesting phenomenon will be noticed at once. The second half of the song is almost an exact repetition of the first half, except that it is a couple of notes higher. This is exactly what is heard, although some observers have guessed that the second half was a full octave higher than the first." Perhaps individual Winter Wrens make different transpositions.

I have the sound film of a Hermit Thrush's song. I have not yet had time to transcribe it, but I know from ear that it can be defined as a series of modulations—very rapid inverted arpeggios, with long pauses between, each phrase introduced by a single note, long drawn out, on a different pitch, striking the tonic, as it were, of the new chord in the new key—a piling up of overtones on shifting fundamentals.

OLIVE-BACKED THRUSH

(From the victrola record)

It would seem that the Olive-backed Thrush is singing arpeggios which contain not only the notes of our common chord (the fourth, fifth, sixth and

eighth partials), but also the seventh partial, omitted in our music. This chart (Pl. 24, fig. 2) is the first of four sheets recording a song with five different phrases. They are all somewhat similar, variations of arpeggios, climbing to a rather uncertain octave, but the first is the clearest. The frequencies were not easy to read on the victrola record. In America the thrushes, the Wood Thrush, the Hermit and the Olive-backed, all sing variations of arpeggios based on the common chord.

BROWN THRASHER

(Variable amplitude film)

This fragment (Pl. 24, fig. 3) is not nearly long enough to give the complicated rhythmic repetitions for which the Thrasher is famous. The notes are slurred and look quite irregular, although one can discover a wavering tendency to pitch some of them around a tonic of 1750, with an octave of 3500 and with once a rise to a second octave of roughly 7000, a very high pitch, showing the wide range of the Thrasher's music.

By far the most interesting notes in this record are the very long slurs at the end. The one which goes both up and down is remarkable because it is an almost perfect example of an arithmetic scale or slide, that is to say, a scale in which the pitch rises by even arithmetic increases in even time. This slur is the best proof of an arithmetic scale in bird song that I have so far found among these few examples. When many more transcriptions have been made, we shall be able to tell better whether it is a mere accident or not.

Though a great many birds, for instance, the Screech Owl, the wood-peckers, even the Robin, sing small fragments of a scale, it so happened that none was recorded on this material that I was studying, so I paid particular attention instead to the slides, of which there were many, for it is a fact that slurs and slides are much more common in bird song and in primitive music than the long tone ladder with regular steps, as we know it in our music.

No one understands exactly how changes of pitch are made in a bird's throat, but it would seem that a gradual and continuous slide can be made almost automatically, but at different rates of increase, a matter perhaps of degrees of energy of muscular contraction. The slides recorded on my charts have different curves and lines, showing that the increase of frequencies can approximate an arithmetic progression in its timing, or a geometric progression, like that of our own scale in which the frequencies double in even time, or an even more rapid and explosive rate of speed, as in the Chestnut-sided Warbler's song. From the point of view of musical theory, the arithmetic slide is particularly interesting because it provides a natural framework with even timing for the physical scale of overtones.

The slur at the very end of the Thrasher's song covers slightly over two octaves, from 1750 to 7000, but unfortunately it is not perfectly smooth, there is a hitch in the middle. It has, however, one important characteristic of the arithmetic scale: the higher octave took the Thrasher twice as long to sing as the lower octave. If this slur were automatically 'interrupted,' that is to say, divided into separate, evenly timed notes, the upper octave would have twice as many notes as the lower.

WHITE-THROATED SPARROW

(Variable amplitude film)

Four notes on a monotone, to the rhythm of 'Sam Peabody' (Pl. 25, fig. 4). Though so simple, this record is very interesting. Under the microscope the monotonous notes reveal an effect of alternating dynamics very delicately varied and controlled. The notes are long drawn out and the pitch is held very steadily, which is most unusual for a bird—such deviations as there are may be due to fractional errors in my counting. In the first note there are four alternations between *ff* and *mp*, in the second note the underlining of the accent shows as a slur, like a little upward push, rising to a longer *ff* which only dies away at the end of the note. The last two notes each have three alternations from *f* to *p*.

It is clear that in this case the wavering, floating, tenuous quality of a Whitethroat's note is not a wavering from pitch, it is a matter of very subtle variations in dynamics, like the vibrato on a violin, with the accented note treated quite differently from the three others. The tempo is very slow; the pitch 4000 frequencies, that is, very close to C7, two octaves higher than the high C of a light soprano.

SONG SPARROW

(Variable density film)

The transcription (Pl. 25, fig. 5) covers about two seconds and a half of the opening of a Song Sparrow's song. The three staccato notes to begin with seem very familiar, and yet it is a surprise to learn that each one of them lasts only 1/66th of a second, and that the pauses between are five times as long as the notes themselves. To our ears, owing to the reverberations, there would hardly seem to be any pauses for silence, but the effect of the three notes would be very staccato.

The long interrupted note coming after the three opening ones was still more of a surprise. At first I was inclined to call it a trill, because it looked like one, but the speed of the beats was so extraordinarily rapid, and their succession so perfectly rhythmic and regular, as if produced automatically, that I have come to think that it must be one of those odd fricative or

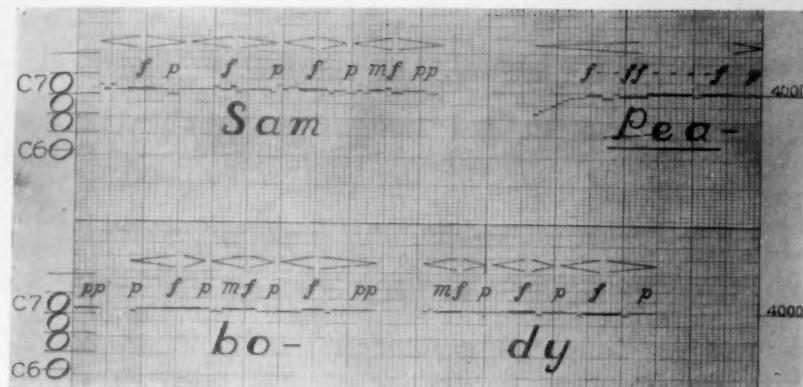


FIG. 4.—SONG OF THE WHITE-THROATED SPARROW

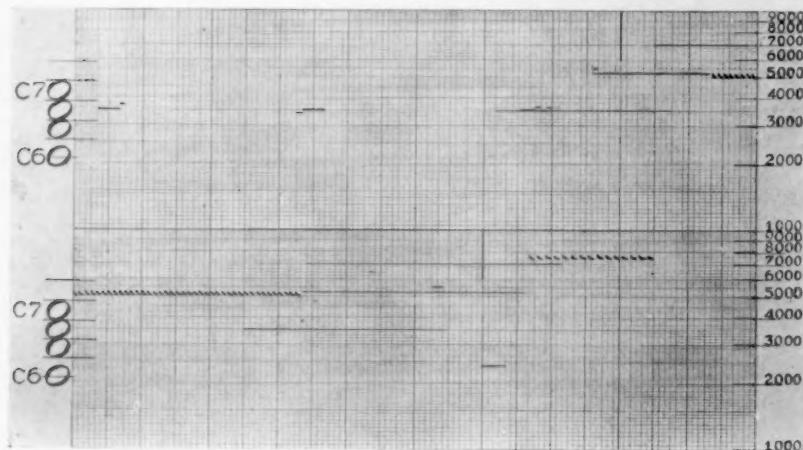


FIG. 5.—SONG OF THE SONG SPARROW

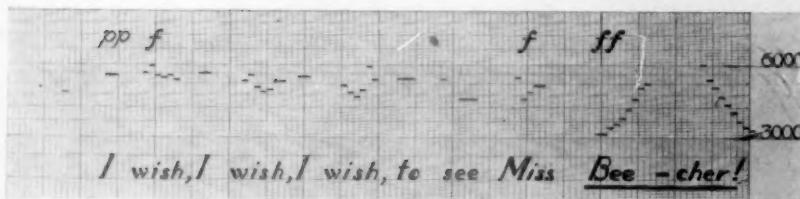


FIG. 6.—SONG OF THE CHESTNUT-SIDED WARBLER

wheezy notes of which we hear such a variety in bird songs, a sound with something like a *z* or an *r* in it, and yet not quite either. A trill at that speed, one hundred beats to a second, would hardly sound like an ordinary trill. The pitch was around 5000. The whole note or trill actually consisted of about forty-eight beats, or tiny separated notes, and each of these beats was made up of a group of about thirty-five vibrations, with the first ten waves distinctly higher in pitch than the rest; how much higher it was difficult for me to tell, because my time unit of one hundredth of a second was not fine enough for the necessary measurement.

The last note on the record was another interrupted one, but with beats not quite so rapid. What would be the difference in effect to our ears, I cannot say.

Mr. Brand was also surprised at the speed of bird notes. He recorded that "many of the notes in the Song Sparrow's song and in the songs of many other species are of incredibly short duration, so short that they could not possibly be heard by the human ear except in combination with the preceding or following notes." He also found "the abrupt and lightning quick changes of pitch" in the Winter Wren's song most astonishing. One might fancy that the whole tempo of bird life were speedier than our own, and the little birds speedier than the big birds. In flight-songs the rhythm of the music may be set to the beat of the wings and we know now how extraordinarily rapid that may be.

CHESTNUT-SIDED WARBLER

(Variable density film)

It is amusing to see how closely and exactly this microscopic record (Pl. 25, fig. 6) fits the catch phrase, 'I wish, I wish, I wish to see Miss Beecher!' except that we should normally need three or four seconds to say it, whereas Miss Beecher's lively little friend takes scarcely more than one second.

The song is much more like an emphatic sentence made up of words than it is like a phrase of abstract music. The rhythm, of course, is very familiar, actually that of iambic blank verse, rising with force and intention to a climax. Harmonious intervals are lacking, but there are complex inflections, ending with the characteristic, explosive little slur up and down.

It may be noticed on the chart that the slurring makes a concave upward curve. This means that the speed of increase of pitch is even greater than geometric, for our own logarithmic scale would show as a straight line on this semi-log paper. The slow arithmetic scale, as in the Thrasher's song, shows as a convex upward slur.

OUR OWN MUSICAL INSTINCT AND THE PHYSICAL SCALE

I am not considering here the tempo, the rhythm or the dynamics of bird song, different and fascinating as these are, or the slurring and trilling, but simply the question of musical intervals. I must apologize to 'The Auk' for seeming to stray away from the subject of ornithology, but can only say that my original purpose was rather general. I wanted to study bird song and musical instinct from the point of view of theory, and then look back again at our own music from out-of-doors, so to speak. Our music is based upon a scale which we never hear in Nature. How can this be? There is a wide gap between the very simplest form of our musical art and that of birds.

As one might have expected, I found by these charts that the birds were occasionally singing intervals in simple arithmetic ratios, and occasionally transposing them. Then I found the long slide in the Thrasher's song where the change of frequencies was an arithmetic progression, the numbers increasing evenly and in even time. What deductions can one draw from these simple facts?

One day, out of idle curiosity, when I was just beginning this work, I drew the graph of an arithmetic scale on semi-logarithmic paper and was interested to discover that at regular intervals on this slide appeared a series of musical intervals which looked extremely familiar in their order, as if they must have some basic musical significance, first the octave, then the fifth, then the notes of the common chord, plus the seventh, till a succession of eight intervals was reached very similar to our old 'natural' diatonic scale of seven intervals. For several weeks, actually, I told myself that the birds must be singing 'arithmetic' intervals before I discovered that I had stumbled unawares upon the theoretic framework of those very overtones that I had been looking at with such interest through the microscope, and that their proper nomenclature was the series of overtones, or Helmholtz Order of Harmonic Partials. They were indeed fundamental to all music and to the science of acoustics, being based upon the law of the reinforcement of sound. According to this law, higher-pitched sound waves often occur automatically as exact multiples of a fundamental, and they produce resonance by reinforcing and intensifying the fundamental, whereas multiple sound waves which do not fit each other are out of tune, so that the haphazard currents produce either impure tones or silence.

When I first began this study I had no preconceived idea as to what I should find. I thought, conventionally, that the octave scale, possibly the well-tempered scale of Bach, was the basis of our music. I have now come to a different conclusion: I think both birds and human beings are instinctively sensitive to the natural or physical scale of overtones, created auto-

matically in any vibrating column of air according to the law of resonance. And I think we are directly sensitive, musically, to the ratios of this same law of resonance and reinforcement, whether they apply only to multiple vibrations from a single source, or to all patterns of sound waves that meet and mingle in the air and fit and flow together—like the perfect playing of the Flonzaley quartet. An octave is still an octave to our ears when it is played by two instruments.

Recent researches by the Bell Telephone Company show that the human ear is built on the lines of an extremely complex, very minute grand piano, with 24,000 vibrating fibers for strings stretched across the basilar membrane, the shorter fibers more taut, the bass fibers looser. Each fiber vibrates more strongly to a sound wave of its own frequency, according to the law of resonance, and missing overtones or missing fundamentals can be created automatically by the irregular shape of the ear drum.

Some of the lower animals have ears even more complex in some respects than ours, but the number of vibrating fibers is usually less. Birds have only 3000; otherwise their mechanism is similar to ours and is explained by what is called the 'resonance theory of hearing.' If we accept the resonance theory, it seems natural to assume that the basis of instinctive music must be the physical scale of overtones, created automatically according to the law of resonance.

The term instinctive music, of course, covers much more than merely bird song. It has been noted by the psychologists that we ourselves use musical intervals in our speech, especially in exclamations. Octaves, fifths, fourths, major thirds and minor thirds, we speak and cry them all to express various shades of feeling, but with the same sort of vagueness and inaccuracy that is heard in the songs of birds, the ratios so wrapped around in ambiguous slurs and slides and random wavering that only a few people such as actors and natural mimics can consciously control them. These inflections are probably based on the overtones, and it is entirely possible that we use the seventh partial, for instance, to express some perfectly familiar and unmistakable shade of feeling, just as instinctively and without being any more aware of what we are doing than is the Olive-backed Thrush.

Having plotted them on a graph, I knew that the overtones in their regular order formed a kind of natural musical scale, and it occurred to me that it might be worth while, for a better understanding of the essential difference between our art music and bird song, to make a comparison between the characteristics of this scale and those of our own two scales, the diatonic and the chromatic.

The physical scale is an "infinitely variable" series, and contains, theoretically, all the possible notes that are in harmonic relationship to one fundamental and consequently in pure intonation. Defined according to

frequency numbers, it is an arithmetic series in which the number of the fundamental is the same as the unit of increase. If the fundamental is 1, the series is 1, 2, 3, 4, 5, 6, 7, etc., ad infinitum, the familiar a, b, c of mathematics. If the fundamental is 32, as roughly for the key of C, the unit of increase is also 32 and we arrive at 256 frequencies for middle C.

Defined according to relative wave lengths or frequency timing, the physical scale becomes a quite different series of diminishing ratios:

$$1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12}, \frac{1}{13}, \text{ etc.}$$

Through our sense of hearing it is evident that we perceive this series not according to the first definition, as an arithmetic series of equal increases, but as a succession of musical intervals diminishing with a diminishing difference. This may be explained either by the second definition, or according to the Weber-Fechner law, closely related to it.

The Weber law is usually stated in this way: If the stimuli are increasing in geometrical progression, the sensations increase only arithmetically, in other words the sensations lag behind the stimuli. But in the case of the physical scale, the stimuli, the frequency numbers of the notes, are *not* advancing geometrically; it so happens that they are advancing evenly and precisely as an arithmetic progression. If we still assume that the relation of stimulus and sensation is logarithmic and apply Fechner's equation, then we find that the overtones must be visualized as a diminishing series according to Gunter's logarithmic scale:



The spacing of the lines on semi-logarithmic paper is according to this very Gunter's logarithmic scale, so the paper is therefore perfectly adapted to the plotting of overtone scales.

So far as I know, Gunter's logarithmic scale has never before been used in connection with musical theory, but I believe it may serve to emphasize the main characteristics of the physical scale, and in so doing clear up certain misconceptions as to our sense of pitch, which is logarithmic, and our instinct for pure intonation, which is connected with an arithmetic series of frequencies. It shows that the two can be easily reconciled.

Now as to the relationship between our present musical scales and this foundation of instinctive music that we share with the birds and lower animals. The pre-Bach diatonic scale, with its original tuning, *do re mi fa sol la si do*, was a scale of uneven intervals in pure intonation, closely related to the fourth octave of overtones, as may be seen by glancing at a

table of comparative frequency numbers. *Do re mi sol si do* are identical in both scales, *fa* and *la* were obtained by inversion from upper C but every interval can be found among the lower partials. One could hardly look for better evidence than this to prove that our musical instinct is sensitive to the physical scale, for music anticipated science by 2500 years in its discovery and utilization of practically the first four octaves of overtones. The Pythagorean scale is essentially a fragment of the physical scale, but not perfect and complete, for the seventh partial and its derivatives are conspicuous by their absence.

On the other hand, the well-tempered scale with its complex fractions is a product of higher mathematics, and the birds do not use it because they can make changes of tonality instinctively. It corresponds to our logarithmic sense of pitch, but it does not entirely satisfy our sense of harmony and pure intonation, for these follow the law of resonance which requires that musical intervals, to be perfectly in tune, must be exact multiples of their fundamental.

Order of Harmonic Partials or Series of Overtones

With 32 frequencies as arithmetic increase, in the key of C

32 64 96 128 160 192 224 256 288 320 352 384 416 448 480

1024

(waves that fit and reinforce each other)

(Notes printed black are differently tuned)

SCALES

Arithmetic		Old Diatonic				Tempered or logarithmic	
ratio	in 8ths	ratio	C	256	C	256	
	256				C $\#$	271.2	
9/8	288	9/8	D	288	D $\#$	287.3	
10/9	320	5/4	E	320	D $\#$	304.4	
11/9	352	4/3	F	341 1/3	E	322.5	
					F	341.7	

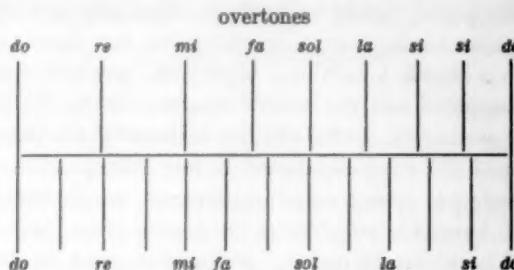
SCALES—Continued

Arithmetic		Old Diatonic				Tempered	
ratio	in 8ths	ratio				or logarithmic	
12/8	384	3/2	G	384		F #	362
13/8	416	5/3	A			G	383.6
14/8	448	5/3	A	426 1/3		G #	406.4
15/8	480	15/8	B	480		A	430.5
16/8	512	16/8	C	512		A #	456.1
						B	483.2
						C	512

An automatic capacity for modulation or transposition is one of the most significant manifestations of our musical instinct. We can sing a tune not merely in one key, or merely in twelve keys, but at any desired pitch within our vocal range, and this without any mental effort. No doubt the faculty is connected with our subconscious perception of the ratios of overtones, which are constantly being piled up at lightning speed on rapidly shifting fundamentals. If we had to make changes of tonality rationally, calculating frequency ratios by mental arithmetic, we would find the process quite lengthy and tedious.

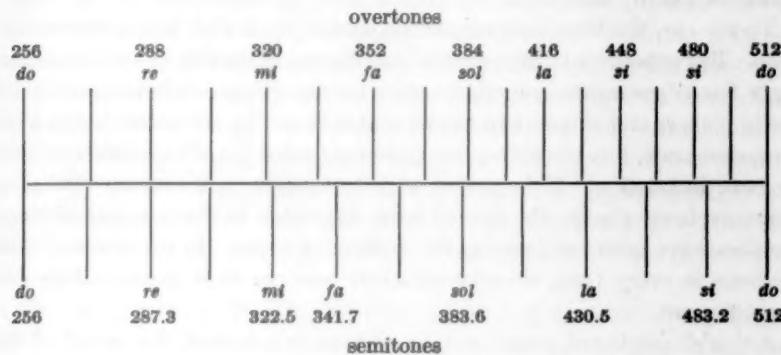
On primitive stringed instruments the player could make changes of key instinctively, by sliding his fingers up and down till they found the pitch required by his ear. But when complex instruments like the harpsichord and the clavichord were designed, with immovable keys, the number of fixed notes required for any real freedom of transposition of the pure diatonic scale would have been very large, for the intervals did not fit each other. The instrument presented the difficulty, and the difficulty was solved by changing not the instrument but the scale—a new scale was introduced based on mathematical theory, a logarithmic scale of equal ratios, dividing each octave into twelve equal musical intervals called semitones. The frequency numbers of these semitones advance by gradually bigger and bigger leaps, doubling with every octave, like compound interest doubling in twelve years.

Of course, logarithmic equal-interval scales could be devised according to any number, 7, 10, 53, any number to the octave, and one could foretell of all of them that they would be partly out of tune, and that their equal intervals would seem to us to have harmonic significance only in so far as they happened to approximate overtone intervals. No doubt the number twelve was chosen because it gave the best fit, very good in the lower half of the octave, not so good in the upper. The old diatonic scale was differently tuned to fit into the new mold, and could now be repeated slightly

Overtones measured by their Ratios fitted to Logarithms in Twelfths

Ratios of fourth octave of overtones, in arithmetic eightths, assuming four inches as wave-length of fundamental.

Ratios of fifth octave of overtones, in arithmetic sixteenths, assuming eight inches as wave-length of fundamental.



out of tune anywhere up and down a ladder of continuous equal semitones, covering six or seven octaves. If a modern inventor were faced with this same problem of transposition, he might perhaps be able to solve it mechanically, and then we could imagine the natural scale liberated from its present shackles.

No doubt a scale of equal intervals has certain aesthetic qualities that a scale of diminishing intervals could never exactly reproduce. It appeals, perhaps, to an artistic instinct of a more general order, the instinct for equal measurements, as in formal design or metrical verse. Yet it is not the whole of music—it never was; beautiful music was written, too, before the eighteenth century.

Possibly with the further development of research in sound photography, musicians may become more and more interested in overtones and instinctive music, and may at last wish that they could hear the natural scale in all its purity and judge for themselves as to its musical possibilities.

One can imagine an instrument on which the compromise, the fusion of two incompatible scales, would be made mechanically instead of theoretically by ambiguous tuning, etc., something like the piano or the electric organ, but with a double logarithmic keyboard, on which could be played both the well-tempered and the natural overtone scale, the latter fitted if possible with an automatic device which would enable the player to raise or lower the pitch of the whole keyboard to any transposition required. If the overtone scale has true musical significance, we should then hear an instrument with harmonic possibilities far greater than those of the piano. Logical lines of harmonic or melodic progression could be developed continuously up and down the whole keyboard instead of being limited by the convention of repeating, identical octaves. Each octave would repeat the notes of the next lower octave, but with additional finer intervals between. Octave scales in pure intonation could be played from any note but no two would be exactly identical.

To the ear, the finer intervals would merge, no doubt, into a continuous slide. But experiments have shown that the ear is capable of making amazingly fine adjustments, sometimes quite unconsciously. For instance, good violin players and singers can adjust themselves with the piano to the well-tempered scale, but when they are unaccompanied they instinctively revert to pure intonation. This proves what we might well expect, that pure overtone intervals are the line of least resistance to our musical instinct, for they have been our heritage for millions of years. In every sound that we hear, in every tone, we subconsciously analyze their permutations and combinations.

A double keyboard would not be so very impractical, for many of the notes are almost identical and the greater scale would include the lesser. Of course, the new keyboard would have to be more complicated, with thinner keys in increasing rows in the upper registers.

But this is a flight of fancy, an outgrowth of a very simple idea, namely, that the intervals of the lower overtones are to be heard in the songs of birds, sung and repeated and transposed deliberately. Of course, the theory of a physical basis to music is not in the least new or original.

I do not believe that birds have any scale or musical system of their own; I think they are quite innocent of any such artificial scheme, but yet are sensitive in much the same way as we are to the laws of Nature, not only through the mechanism of their ears but with all their being.

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OBSERVATIONS AT A RUFOUS HUMMINGBIRD'S NEST

BY A. DAWES DUBOIS

Plate 26

So precarious is the nursery life of birds that the completion of a nest study at a chosen nest is altogether uncertain, if not indeed improbable. In the present instance the observations came to a premature end; they relate to the last two days of incubation and the first twelve days of nestlinghood. The notes were made in the summer of 1914, at a nest of the Rufous Hummingbird (*Selasphorus rufus*), in the western foothills of the Rocky Mountains, near Belton, Flathead County, Montana. The nest was found on the 15th of July. Rufous Hummingbirds had previously visited the flowers in the small clearing surrounding the Forest Ranger's cabin; and on that morning, when the sun came up invitingly over the foothills, I was seized with a desire to find a hummer's nest. Entering the woods at the Ranger's spring, I started to climb the steep hill which rises there, but had proceeded scarcely twenty paces when a startling hum arrested me. Among the lower branches of a birch, close at my side, a young balsam fir had crowded its way upward; and in this small fir, some five feet from the ground, was the object of my excursion. When I had seated myself at a little distance, the bird hummed around her premises for a short time and then returned to her two eggs. It was plain that she was not in any great fear of man.

The nest was visited every day from the 15th to the 27th of July, sometimes for several hours of watching, sometimes only for brief inspection.

Nest.—The nest was composed of soft, cottony, plant materials, felted together, and thickly covered exteriorly with lichens held in place by cobwebs. It measured: inside, diameter one inch at the rim, depth seven-eighths of an inch; outside, diameter one and seven-eighths inches at bulge, depth one and a quarter inches. Its situation, as previously mentioned, was about five feet from the ground in a small balsam fir, at the bottom of the steep slope of a foothill. The foothills of the vicinity were variously wooded, chiefly with larch, spruce, hemlock, fir and cedar, with a growth of birch particularly on this slope.

Last days of incubation.—On the morning of the 16th the bird remained in the nest while I cautiously approached, and permitted me to examine her at a distance of eighteen inches and less for the greater part of a minute. When she took wing she flew to a twig in a dead windfall and sat there perfecting her toilet. I retreated to a little distance, to watch with the field-glass, and soon the bird returned to the nest. She approached it in a series of dashes, and poised for a moment just over the nest cup—her wings

humming, her iridescent feathers glistening in the shafts of sunlight—then dropped suddenly and accurately into the nest, disdaining to touch its walls with her feet. She drew herself well down into the deep cavity; and for a little while squirmed, and tossed her head from side to side. Meanwhile her breathing was heavy and her tail beat time, moving up and down very slightly, with a frequency of three or four cycles per second.

She was off the nest when I arrived in the afternoon and remained off for more than an hour. She would go away occasionally, for rather long periods, only to return to a twig on a dead tree, where she seemed more concerned with preening her plumage than with the temperature of the eggs. The day was cool, but the warm sun was shining on the nest nearly all of this time. She was incubating when I left, about 6.30 p. m.

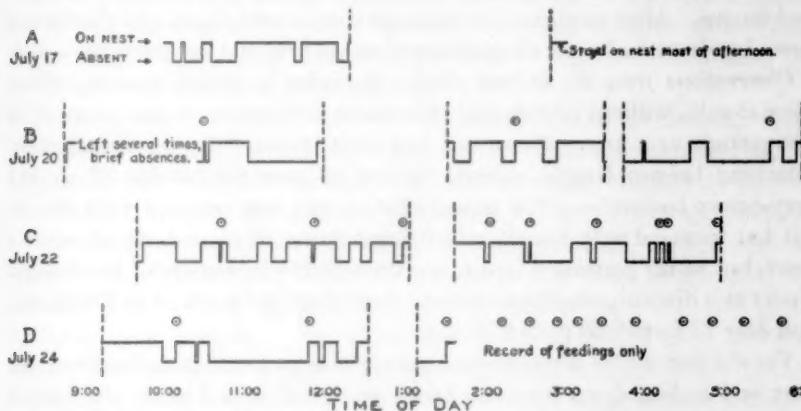
Upon arriving at the nest on the 17th, I found that one of the eggs had dried and most of the shell had fallen away, leaving the lining intact but shriveled. The pieces of shell were in the nest. It had been noticed the previous morning that at least one-fourth of this egg was occupied by an air space. A photograph was taken at 9.30 a. m., and when that disturbance was over, the voluntary goings and comings of the bird were watched from a little distance (see chart, Text-fig. 1).

The bird, while incubating, had faced toward the south, which was the open exposure, but I found her facing north at the beginning of the afternoon of the 17th. She stayed at her post almost continuously through that long, warm afternoon, facing now in one direction, now in another. About mid-afternoon she was absent for a minute or two. Soon after her return, the hot sun began to shine on the nest through a gap in the foliage; then she stood up in the nest, stretched to her full height, her back toward the sun, protecting the eggs with her tiny shadow. She continued to stand, panting with the heat, until a tree shadow relieved her; then she went away. She was gone but a few minutes, however, and had returned to the nest, settling into it as usual, before the tree shadow had passed.

Before my arrival the next morning (July 18) the sound egg had hatched and the parent had removed the shell from which the chick had emerged. The shell-lining of the dessicated egg was standing on end beside the young nestling, and the pieces of shell which had fallen from it were still in the bottom of the nest. The dried lining was removed by the writer on the 20th; it was then about two-thirds empty, but was found to contain an embryo in an early stage of development. It is possible that the hummingbird was unable to remove this; yet it may be significant that she did not remove the fragments of shell which fell from it.

First day of infancy.—The parent was brooding the newly hatched nestling when I arrived at nine o'clock (July 18); and she returned to the nest as soon as I moved away. She continued to brood, most of the time, during

the remainder of the forenoon, excepting an absence of some twenty minutes before ten o'clock. But during that absence, a large black and yellow fly (resembling a bee) appeared, and buzzed around the nest. It went repeatedly to the nest rim and finally disappeared within. Hurrying to the rescue I found the helpless nestling squirming as best it could, with the fly, as large as itself, fastened to it. Failing to catch the fly, I drove it away. The young bird, now on its back, continued to squirm until it succeeded in



Text-FIG. 1—Graphical record of brooding periods and feeding intervals.

Graph A—July 17; last day of incubation.

Graph B—July 20; nestling two days old. Day mostly cloudy, temperature moderate and pleasant; thunder-shower at noon; very windy afternoon.

Graph C—July 22; nestling four days old.

Graph D—July 24; nestling six days old.

The upper horizontal lines in each graph indicate duration of brooding periods; the lower horizontal lines indicate duration of absences from nest. Short vertical lines, connecting the upper and lower horizontal lines, mark the times of arrival and departure of parent bird. The time of each feeding is indicated by a dot, circumscribed with a circle. Vertical broken lines mark the beginning and end of continuous watching.

righting itself. Examination disclosed a slight wound at the nape of its neck. When the parent returned, a minute or two later, she first perched in a fallen tree to preen her feathers; then settled into the nest without stopping to inspect its contents.

She left again about eleven, going toward the spring and the clearing, but was gone only about two minutes. Returning, she alighted on the edge of the nest and sat there perhaps ten seconds, poking into the interior of the nest with her bill. Though I could not see exactly what was going on, I surmised that the nestling was receiving its first or possibly its second meal. During the next ten or fifteen minutes the mother bird left the nest twice, for brief absences, going in the same direction. She flew around me upon her return from the first of these excursions, and sat for a moment in

a tree, before settling into the nest. The next time, she settled at once. Late in the day I again examined the bird at very close range; once when I became too inquisitive, she left the nest and flew around me, chirping; but as soon as I had backed away she alighted on the nest rim and sat there for several minutes looking down at the minute black infant. She then flew off, for less than a minute, and returning to the other side of the nest fed the nestling by regurgitation. I could discern some preliminary movements of her throat, and, during the intervals between pokes, movements of her bill and tongue. After prodding about in the nest several times, she clambered down into it with all the awkwardness of an old hen, and sat there, brooding.

Observations from the balsam cloak.—In order to watch the procedure more closely, without introducing extraneous distractions, it was planned to masquerade as a tree. A costume had been prepared for the occasion by attaching balsam boughs, shingle fashion, all over the outside of an old gray-brown bath-robe. The perambulating tree was crowned with an old felt hat trimmed with boughs which hung down all around the observer's head, but which permitted him to see through the interstices of the foliage. Under this disguise, observations were made July 20 from 2.14 to 2.45 p. m., and July 22 from 9.00 until 9.30 a. m.

For the first watch my eyes were only twelve or fourteen inches from the nest and looked down into it. I had stationed myself while the parent bird was away. Soon she returned and alighted on the farther edge of the nest, facing me. The young nestling raised its head and opened its small mouth, and the parent inserted her long bill to half its length. There was very little motion of her bill. She moved it slightly up and down, and the movement of her throat was noticeable as she continued to regurgitate. The nestling twisted its head back and forth around the mother's bill—conveying the uncomfortable impression that the youngster might drill a hole through some vital part of its organism. This lasted several seconds; then the mother withdrew her bill and the nestling dropped its head back into the nest. The parent protruded her tongue several times, and examined the young and the interior of the nest, touching both the nestling and the nest lining in several places with the tip of her bill. Then she took wing with a sudden hum, poised above the nest, and dropped accurately into it, facing me; but soon she began to squirm and turn about in a restless manner, and this she continued until she was facing in the opposite direction.

Unaware of my presence, the little mother continued to brood until my rôle became very wearying. After a time I endeavored very cautiously to back away a few inches. My feet must have made a noise on the ground, for my friend craned her neck and turned her head to one side to look and listen. Not wishing to alarm her, I continued to await her pleasure, until both trunks—for I was a bifurcated tree—seemed on the verge of collapse.

With a persistence resembling perversity, I thought, the little bird stayed complacently in her nest, now and then twiddling her mandibles, and occasionally throwing her head from side to side in a dominant, swaggering manner, with the shining green feathers of her crown ruffled. Her manner seemed the expression of a fearless nature overflowing with mother pride as she felt her offspring beneath her. It was a picture of satisfaction quite pleasant to behold.

But I was finding a deep sympathy with trees. Whenever a breeze stirred the branches of my sylvan brothers I indulged in a little motion also. Eventually the brooding mother relieved me. With a sudden hum she lifted her body and went buzzing away.

There was an intervening day of windy weather; then the morning of the 22d turned propitious and I again donned the cloak and stationed myself beside the nest. On this occasion, however, I was more obtrusively planted than before, being at the open side of the nest, separated from the branches of the living tree; and the hummingbird could not easily accept such an innovation. When she returned she refused at first to go to the nest, but buzzed all around me, chirping her alarm and examining the details of my make-up very minutely. She came close to my nose and ears, hovering before them as before a flower and peering at them through the foliage. I quickly learned how formidable is the boom of her wings at close quarters. Once she seemed to alight in the top of my crown. After this examination she went to her nest for a few moments, only to resume her investigation. Twice she left the nest before settling herself to remain there.

Two insects, crawling on nose and eyebrow respectively, made perfect immobility on my part quite difficult; and when one of them attempted to bite through the "bark" I transgressed the bounds of tree propriety by swaying in an imaginary breeze, and twisting my trunk, in an effort to lift the off-side hand. The bird in the nest stretched out her neck and eyed me sharply from the crown down. It was asking too much of her. Finally she left the nest again and flew around me close to the ground, examining my boots, wherein I was conscious of many shortcomings. Perhaps she finally appraised me as a clown; anyhow she went away.

Before she returned I had made all readjustments, with eyes ten or twelve inches from the nest. The whole body of the nestling was now plainly visible. It was not long until the parent alighted on the left-hand edge of the nest and proceeded to feed the nestling by regurgitation. It was larger and stronger than on the previous occasion, being now four days old, and accepted the parent's bill for almost its entire length. The motions of the mother's throat were plainly visible, and her bill moved slightly up and down, but the young bird did not screw its neck around her bill so vigorously as before. Having withdrawn her bill for a moment, the parent repeated

the feeding, the little one opening its mouth again when she touched it with her bill. (Its eyes had not yet begun to open.) When the second regurgitation had been finished she repeated it once more, making three separate regurgitations in all. Then she touched the nestling and the lining of the nest in several places with the tip of her tongue, and, vibrating her wings, fluttered into the nest and settled her plumage for brooding. She did not take excreta from the nest, nor did the nestling emit any.

After watching the mother bird a few minutes longer, I began to sway very gently from side to side, meanwhile edging slowly away. Again the hummingbird watched with rapt attention. The tree I personated moved almost imperceptibly at first, but finally, with all due dignity, turned upon its roots and proceeded to a respectful distance. It would be difficult to guess what degree of primitive wonderment possessed the little hummer. She stayed on her nest and watched the miraculous phenomenon, seemingly with amazement and misgiving, her neck craned up to an almost incredible height. I left the premises at once. When I returned the hummer was away.

Brooding periods and feeding intervals.—At two o'clock on the 19th, the mother bird was standing in the nest with her back toward the sun, though the nest was then partly in shadow. That afternoon she remained at her post during the hour that I watched, excepting an absence of about one minute. She stood up in the nest when the sun shone on it, and sat when in the shade of foliage. She was absent at 8.45 that evening, but returned in a few minutes and was brooding when I left at 8.55. The daylight was then beginning to fade rapidly.

Absences and brooding periods observed on the 20th, 22d and 24th are indicated by the graphs (Text-fig. 1). At 8.45 p. m. of the 20th, the bird was absent, but she returned within five minutes, very swiftly, describing a letter *S* through the foliage and settling into the nest without any preliminaries. The air was rather cool, and it was cloudy and getting dark.

From the 25th to 28th the parent was absent much of the time during the mornings, though usually brooding at the time of my first visit. In the afternoons she had to shelter the nestling from the sun. In the evening of the 26th she fed the nestling at about eight o'clock, just after sunset, then stayed away until darkness was coming on.

In Text-fig. 1 the time of each feeding is indicated by a dot circumscribed with a circle. When the nestling was two days old it was fed only three times during seven and one-half hours of actual watching. When four days old it was fed nine times in six and three-quarters hours, the seven known intervals averaging about forty-four minutes. When six days old, although fed only twice during nearly three and a half hours before noon, it received eleven feedings in the afternoon before six o'clock. The average of eleven known intervals, for the whole time watched that day, was thirty-two

minutes. From the 25th to the 28th it was fed very little between eight o'clock and noon, but the afternoon feedings were, as before, more frequent, while the parent also had to shelter the nestling from the sun.

Mode of entering and leaving nest.—The hummer's usual method of entering the nest from the air, during incubation, has been described. After the egg had hatched she continued to settle into the nest in the same manner if returning to brood without feeding the young. When feeding she stood on the rim of the nest, and afterward often remained there for a little while before entering the nest to brood. After feeding the youngster the first day, she was seen to clamber down, awkwardly, as already mentioned, in striking contrast to the usual method of entering from the air. This method of stepping down into the nest was noted several times subsequently; but frequently after feeding she took wing and dropped into the nest, as observed from the balsam cloak (July 20 and 22). One day the parent came to the nest and fed the nestling while I was focusing the camera, and I watched her image on the ground glass. This time she hopped into the nest, catching herself with her chin on the opposite side of the rim.

In leaving the nest she sometimes executed a very pretty and graceful preliminary movement by lifting her wings and stretching them up vertically until they almost met above her back. She paused thus for a moment; then a hum and she was off. At other times she took wing from the nest so quickly that it was impossible for the eye to follow any preliminary movement of the wings.

Process of feeding and brooding young.—It was usual for the parent to pause a few seconds on the edge of the nest, upon arriving, before proceeding with the business of feeding the youngster. So far as my ears could detect, no vocal sound was ever uttered by the parent as a signal to the nestling when she came to the nest rim to feed or to brood. Under ordinary circumstances she seemed to use her voice very little, although she chirped when much agitated, as previously mentioned. When the nestling was two days old, I heard the mother chirping for a moment from the branch of a fallen tree not far away, whence she came to the nest and settled into it. During one of the feedings, when the youngster was six days old, it hung its head over the edge of the nest before its mother was through; she pecked it on the back of the head, it pulled back into the nest with alacrity, and she fed it once more.

On the 20th, during the 10.30 feeding, there was no pushing up and down. The youngster's head was raised high and the mother's bill was inserted a long way into its throat; then she seemed to pump the fluid by just the slightest visible motion of her own throat. But at 5.35 the same day she poked rather vigorously while regurgitating; and two days later the poking was extremely vigorous. When four days old the nestling received almost

all of the parent's bill; and at the age of five and a half days, responding very vigorously, it took the entire length of her bill into its throat.

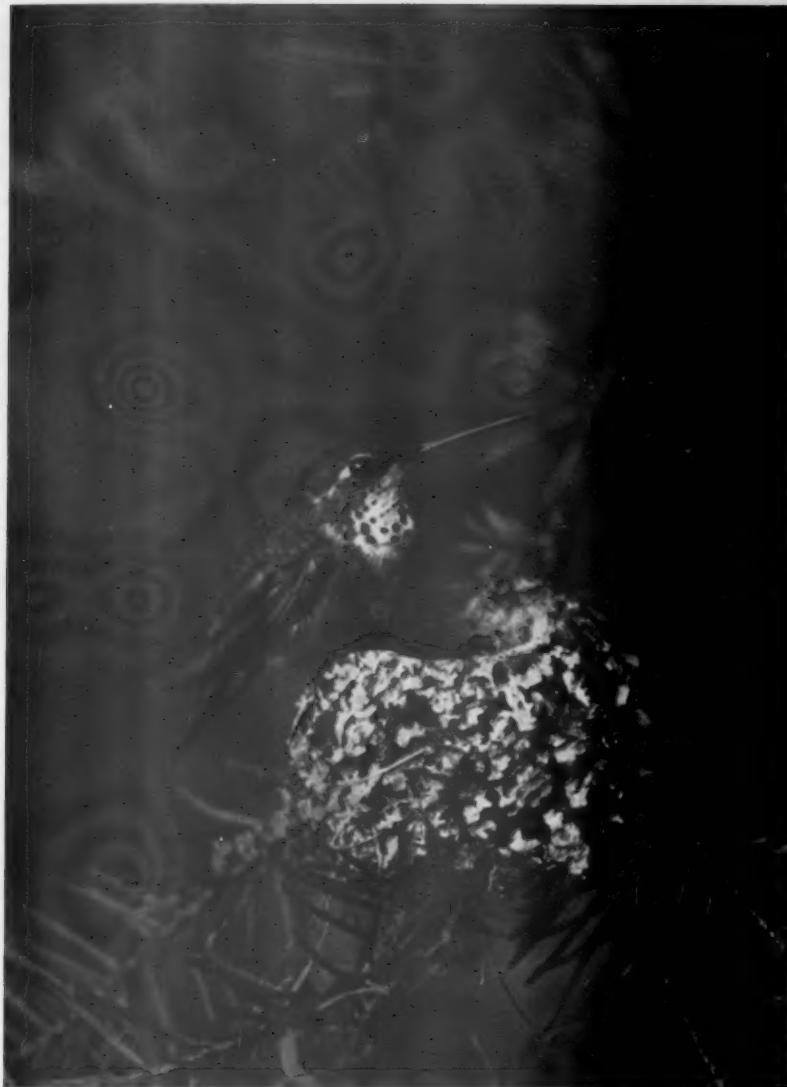
The young bird's head moved up and down with the mother's bill (as noted particularly on the 24th). During one of the feedings I could see the liquid welling up in the young bird's mouth. At the approach of noon on the 26th, I presented a twig about the size of the mother's bill, which the nestling took into its throat to the extent of three-fourths of an inch. The following day it accepted a grass stem carrying a drop of diluted honey, to about the same extent, afterward sticking out its tongue and smacking its mandibles.

The number of regurgitations for each feeding varied from two to five. Two pumpings were noticed at a morning feeding on the 24th. The parent regurgitated five times, just before noon on the 22d; and at the one o'clock feeding she regurgitated four times, poking very vigorously. The total time occupied for the five pumpings and subsequent examination and tidying of nest, was somewhat less than one minute. Often, after feeding the nestling, the mother touched the nest with her bill or tongue, in one or more places, before she entered it to brood. In the afternoon of the 22d (4.55) she stood on the edge of the nest for four minutes after feeding, before entering it.

Upon returning from an absence for the purpose of brooding without feeding, the first day, she alighted in the nest facing in the direction of her flight to it, and did not turn around after getting settled. But on the 20th, when she had properly examined the nest after feeding, she went into it at once, ruffling her feathers, squirming, lifting herself with humped back, and stretching her body lengthwise as though enlarging the nest. She turned around in the nest, making more than a complete rotation before finally becoming quiet. While she was brooding, an ant crawled along a twig near the nest and she stretched out to get it; but it was beyond her reach and crawling away, so she let it go.

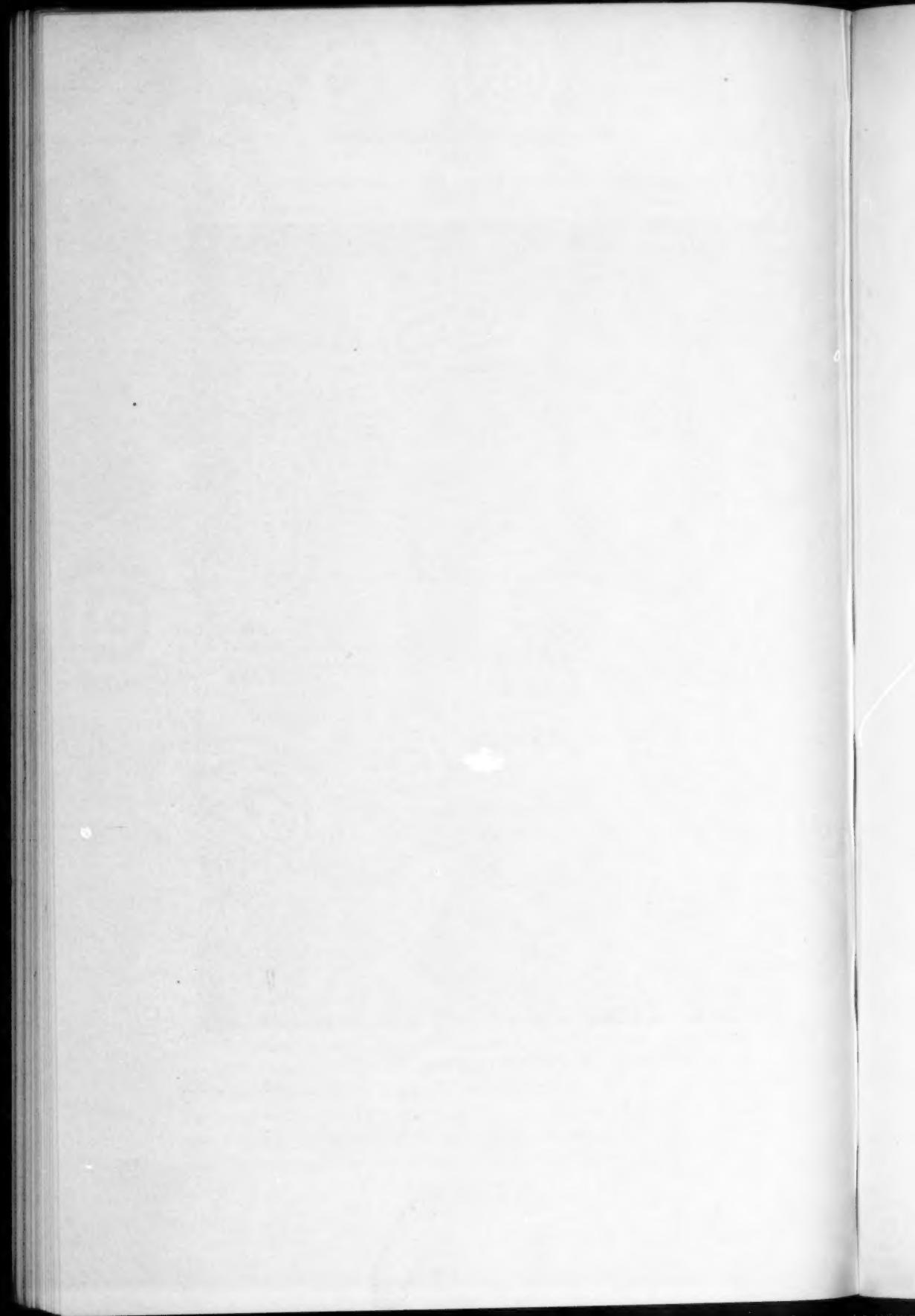
In the afternoon of the 19th the parent thumped her body up and down in the nest as though intent upon stimulating the bodily functions of the young one.

Sanitation of nest.—The alvine discharges of the young hummingbird were forcibly ejected in a manner to render nest cleaning unnecessary—at least after the nestling was a few days old. When closely observed from the balsam cloak (July 22) the nestling did not emit excrement after being fed. On the 23d, while the parent was absent, I observed the method employed by the nestling, then five days old. Following a slight shaking of the nest, it struggled to reach the top of the nest wall. The great depth of the nest made this very difficult, but the young bird accomplished it, standing literally on its head, braced against the wall of the nest. The discharge was projected to a distance of several inches beyond the nest.



FEMALE RUFous HUMMINGBIRD ON EDGE OF NEST

Copyright by the author



Examination revealed discal specks of black matter, white at the middle, in several places on top of the nest rim. These were shown by a magnifying glass to be excreta, seeming to indicate that in earlier infancy the nestling had not always been completely successful in clearing the rim. With two birds in a nest it would probably be less difficult. Some of the specks were found on twigs and fir needles, at the height of the nest, as far as six inches away.

The powers of the adult in this respect had been noted while the bird was incubating; she had been seen to discharge excrement to a distance of eight or ten inches (at nest level) by merely lifting the body slightly.

Food-getting, drinking, bathing and preening habits.—On the morning of the 24th I watched this or some other hummingbird feeding in a novel manner over the small garden in the clearing. She was about thirty feet in the air, now poised on vibrating wings, now darting here and there like a dragonfly, evidently engaged in catching small insects on the wing. Sometimes, upon returning to her nest after an absence, she protruded her tongue to an extent almost equal to the length of her bill. She paid no attention to a red-clover blossom which I dipped in diluted honey and hung on a branch near the nest.

On one occasion, when I saw her drinking at the spring (July 22), she hovered above the pool as she would above a flower, dipping her bill into the water several times. On the 27th I saw her getting water at the spring in a different manner. She stood, for a second or two at a time, in the film of water which flowed over a board, and dipped her bill into it several times. When she left the spring she went directly to the nest.

About three weeks previous to the finding of this nest I had seen a hummingbird bathing at the spring. Its method was in no way different from that of passerine birds.

On the second day of my acquaintance with the nesting bird, after I had flushed her from the nest, she sat on a twig flicking her tail, sticking out her tongue, scratching herself with one foot, and shaking her plumage after the manner of a bird just emerged from a dust bath. In order to perform the feat of scratching her head she held out one wing and thrust her foot through the space between wing and body, reaching over the wing in this manner, close to the shoulder joint.

Behavior in relation to other species.—Once, during the afternoon of July 17, while the hummingbird was incubating, an Olive-backed Thrush inadvertently came too close to the nest. The little bird darted after it so suddenly and violently that she made it squawk; and it lost no time in leaving the neighborhood. Another intruder was a chipmunk. It was searching for huckleberries—running on the ground and climbing in the small bushes—and at length this occupation brought it almost beneath the

hummer's nest. She darted at it, evidently filling it with terror; for it beat a hasty retreat, squealing lustily as it ran.

Behavior in relation to man and unprecedented occurrences.—On the second day, when the camera had been placed on a tripod near the nest, the hummer did not seem much afraid of it. She examined it thoroughly several times and from all sides. She would go away for long intervals only to return to a twig in the dead tree, where she seemed more concerned with preening than with the camera or the eggs. On the second day of her acquaintance with the camera she indicated her indifference by sitting part of the time with her tail toward the instrument.

On the 18th when I came too near while examining her markings, she left the nest and flew around me, chirping; but as soon as I backed away she alighted on the edge of the nest and sat there for several minutes, looking down into it with the air of a proud mother.

On the eighth day of our acquaintance the bird fed her young while my head was under the focusing cloth; but when I moved my hand to adjust the focus she flew from the nest chirping and making a great ado about this new imposture. Later she entered the nest for a moment while I was standing uncovered at the side of the camera. She had but little fear of me in my proper rôle.

The bird's reactions to the balsam cloak have already been described. On the 23d I stood by the nest with only the bough-trimmed hat for a covering. Although evidently suspicious, she returned twice to the nest, brooding each time without feeding. On the 24th I flushed her while setting up the camera; but after a little humming about, and remonstrance expressed by chirping, she went away seemingly confident that I would do no harm.

The resourcefulness of the hummingbird was tried by covering the top of her nest with cotton. At first she attempted to tuck the cotton into the nest wall, but eventually she lifted and pulled it from the nest and let it fall on a bough near by. (For details see 'An experiment with a Rufous Hummingbird,' *Condor*, 25: 157-159, Sept. 1923.)

Other psychical manifestations.—About mid-afternoon of the 22d the wind died down and left a drowsy stillness everywhere. Nature was taking a peaceful nap. The brooding mother closed her eyes at intervals and dozed, until the chirping of a chipmunk made her suddenly alert. A little later, after dozing awhile, she was wakened by an insect flying swiftly past her. This so startled her that she jumped almost out of the nest.

No doubt the smallest of the feathered tribe are subject to irritation and lapses of patience. One morning (July 24) when I purposely flushed the hummer to get her to change position for a photograph, she chased a good-sized bird away from the neighborhood though it had not been close to her

nest; then returned to her task of brooding. Later the same day, while tidying the nest after feeding, the mother bird brought out a tiny fluffy feather which adhered to the end of her bill. Having gotten into the nest to brood, she tried to wipe off the feather on the rim of the nest, but it stuck fast. Then she protruded her tongue two or three times, and the feather was carried off on the end of it but adhered again to her bill each time her tongue was drawn in. Raising her head suddenly, as high as she could reach, with a sharp crook of her neck, she jabbed her bill downward into the inside of the nest wall—and there the feather stayed!

The male hummingbird was never definitely seen. At one time another hummer was sighted sixty or seventy feet away while the female was incubating; and again on the 22d I caught a fleeting glimpse of a hummingbird while the mother was brooding; but apparently she paid no attention to either of these.

Development and behavior of young.—Soon after it had hatched, the nestling was about as large as a worker honeybee. It was nearly black and quite naked except for two slight tracts of grayish down extending longitudinally along the back. It did not raise its head or open its mouth while I was present at the nest.

One day old:—Natal down has grown perceptibly longer. My arrival at nest during parent's absence (8.45 p. m.) caused nestling to hold up its black head, and when I touched its bill it opened its small mouth.

Two days old:—Growing rapidly. Body nearly half an inch long; head about three-sixteenths inch in diameter. Some brownish-buff filaments in the dorsal tracts are approximately three-sixteenths inch in length. Skin seems even blacker than before. Nestling responds by lifting its head and opening its mouth if I chirp faintly by sucking air through teeth; and sometimes when I scratch on a branch.

Five days old:—Body as large as a Chipping Sparrow's egg; still blind, black, and naked excepting the two tracts on the back where the down has grown somewhat longer. Strong enough to respond very vigorously when fed, and takes whole length of the parent's bill into its throat.

Six days old:—Pin feathers just becoming visible on the sides and along the posterior edge of the wing; also in a row where the tail is to grow. A slit is becoming noticeable in the eye-covering. When stretching up its neck, with open mouth, it utters faint ticking sounds, every second or two.

Seven days old:—The 'pins' have come through quite conspicuously on the sides. The nestling nearly covers the bottom of the nest.

Eight days old:—Some filaments are appearing on the top of the head, and the hair-like pin feathers on the sides have grown to a length of perhaps a thirty-second of an inch. The little cracks of eyes, partly opened, show the glistening eyeballs.

Nine days old:—Body now as large as a Song Sparrow's egg. Prominent feather tracts starting along sides of belly. Voice getting stronger and notes more rapidly uttered. Fascinatingly ugly at this stage.

Eleven days old:—Rather well covered with sprouting pin feathers; those in the tail about one-eighth inch long. Wings are well sprouted. Eyes have opened to an ellipse half as wide as long. When the nestling's back was rubbed with a finger, it squirmed around in the nest, closed its eyes, and moved over from one side of the nest to the other, evidently wanting to be rubbed on both sides. At the same time it kept its mouth partly open and uttered the little clicking notes.

Twelve and one-half days old:—The eyes have become well opened.

The voice of the nestling was first noticed when it was six days old. I thought I heard faint clicks or ticking sounds as it stretched up its open mouth; and by placing one ear snugly over the nest, as though it were a telephone receiver, I could hear them distinctly. It repeated its faint tick every second or two. When it was nine days old its notes, repeated with greater frequency, could be heard by attentive listening to a distance of twenty-four inches.

Description of adult female.—It remains to record impressions of the hummingbird's plumage as she appeared in life, in such detail as could be noted during several examinations at very close range. It is believed that such descriptions possess a degree of interest despite numerous shortcomings. A dried skin also has its limitations, and is often an object of quite different aspect from the living bird.

Upper parts: Bright green on the back, nape and wing coverts (a shining green in the sun), but with some gray or fuscous edgings showing. The green nape seems to merge into the more gray or fuscous crown; but when the crown feathers are erected they appear bright green also. The primaries are black, or nearly so.

Under parts: Rusty brown on the sides; white (or whitish) on breast and belly. Pure white on throat, extending almost around to eye. The lower throat is marked with a patch of gray-brown spots; these are fine dots anteriorly, but larger blotches posteriorly, merging into each other on the lower throat or upper breast. The spots are less prominent toward the sides, but they extend across (transversely) and backward, forming a faint wreath across the upper limit of the breast. Close inspection also shows lines of very fine dots radiating from the chin downward, on the upper throat. In certain angles of sunlight the throat patch and dots show brilliant structural colors, sometimes bronze or green, sometimes a bright glistening ruby. In the shade they usually show no definite color.

Head: A rather buffy gray line over the eye, and above this a very narrow obscure dark line (hardly noticeable). Cheek, gray-brown with lighter

(more whitish) streaks extending through it nearly parallel with bill. An obscure whitish curved line (same tint as cheek streaks above mentioned) extends upward from neck and terminates at its upper end in a small distinct white spot back of and joining eye. This spot is scarcely half the diameter of open eye. The curved line separates the face patch from the green of the nape. The bill is black.

Tail: Upper surface of tail, blue-green along middle portion (central feather) merging into blackish tip; rather bright green at base. Broad central feather tapering but rounded at tip. When the outer feathers are slightly spread, as the bird sometimes sits on nest, the end of the tail resembles three blunt spear points of equal length. Outer edges rust-brown on basal half, merging into blackish terminal half, with narrow obscure whitish margin at tip.

The under surface of folded tail is white or greenish white, except tip and the edges near tip. Black at tip, and a black blotch on each edge near the end but separated from the black tip.

Schedule of watches.—July 15, preliminary observations. July 16, cool day; short morning visit; afternoon until 6.30. July 17, most of the day; first photograph 9.30 (Graph A). July 18, from about 9 a. m. until 12.15; other visits early afternoon and at 5 p. m. July 19, brief visit 8.30 a. m.; watch 2 to 3; also 8.45 to 8.55 p. m. July 20, first visit 8 a. m.; principal watches as in Graph B; last visit 8.45 to 8.50 p. m. July 21, very windy; brief visits only (8.00 a. m., 12 m., 5.20 p. m.). July 22, balsam-cloak observations 9 to 9.30; long watches as in Graph C, followed by experiment until about 7 p. m. July 23, short morning visit; others about 4.40 p. m. and in evening. July 24, first observations 7.30 a. m.; continuous as in Graph D; experiment after 5.45; last visit at 8.50 p. m. July 25, shower in forenoon; watched for some time. July 26, much of day, and in evening until dark. July 27, part of both forenoon and afternoon.

On the 28th the observer was called into fire-fighting service, an occupation sufficient in itself. Hasty observation the following morning showed the hummingbird to be brooding; but that evening she was absent and failed to return. The nestling survived the cold night of the 29th, in the felted nest, unbroomed. It begged ravenously for food next day, and special efforts were made to feed and shelter it, at every possible opportunity, but it died within two days.

The mystery of the little mother's disappearance could not be solved with certainty; it is pertinent, however, that a weasel had been seen, six days before, peeping out from the rocks at the spring.

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TONGUE MUSCULATURE OF PASSERINE BIRDS

BY WILLIAM L. ENGELS

INTRODUCTION

THIS paper has two aims: first, the presentation of a general picture of the tongue musculature of passerines; and, second, the correction of a number of bewildering errors in the only extensive description extant of the tongue musculature of the Raven (in Shufeldt, 1890), errors both of commission (descriptions and homologies) and of omission (undescribed muscles). A redescription seems to me desirable for two reasons: Shufeldt's 'Myology of the Raven' is the only commonly available English text which treats the entire musculature of a single passeriform species, and, as such, is frequently used as a guide by students who need to familiarize themselves with avian myology, although its numerous errors make for confusion in the mind of any student not already familiar with the subject; more important is the fact that, as the only complete description of the musculature of the Raven (*Corvus corax*), it is frequently referred to for purposes of comparison, by students working on the musculature of other groups of birds. Errors thus tend to accumulate and to be perpetuated.

The following description of tongue muscles is based on dissections of the Raven (*Corvus corax*), to which the details of origin, insertion and topographical relationships refer. I have dissected also a number of other North American passerines, in all of which the tongue musculature was found to be substantially as described below for the Raven. The forms examined include: CORVIDAE: *Aphelocoma californica*, *Corvus brachyrhynchos*, *Corvus corax*; TROGLODYTIIDAE: *Heleodrytes brunneicapillus*, *Thryomanes bewicki*, *Salpinctes obsoletus*; MIMIDAE: *Mimus polyglottos*, *Dumetella carolinensis*, *Toxostoma rufum*, *Oreoscoptes montanus*; TURDIDAE: *Hylocichla guttata*; LANIIDAE: *Lanius ludovicianus*; ICTERIDAE: *Sturnella neglecta*, *Quiscalus quiscula*, *Euphaëgus cyanocephalus*; FRINGILLIDAE: *Carpodacus mexicanus*, *Spinus psaltria*, *Amphispiza belli*, *Zonotrichia leucophrys*. Since these species represent several families of the suborder Passeres, and since they agree with the Raven in respect to the number and arrangement of the muscles, the description below may be taken as representative, in its general features, of passerine birds. Some differences in details have been noted; the finches, especially, exhibit well-defined variations and seem most likely to repay a comparative, functional or *biologisch-anatomische* study. The arrangement of the muscles in the following description is based on their development in ontogeny as presented by Edgeworth (1935). For terminology, I have depended chiefly on Gadow (1891), since his terms are

in most common usage among avian anatomists. There is included with each name, for the convenience of other students, a partial synonymy which indicates the terms employed by Shufeldt for the Raven, and by Gadow and by Edgeworth for birds in general.

My thanks are due Mr. Ward Russell and Mr. William Richardson, of the California Museum of Vertebrate Zoology, for their efforts in obtaining specimens of the Raven for me.

THE TONGUE MUSCULATURE

The term 'tongue musculature,' as here used, reflects a functional, rather than a morphological viewpoint. It is used to designate certain muscles which are functionally related in that their action effects movements of or in the hyoid apparatus, although they are of diverse origin. There are, of course, no intrinsic tongue muscles in birds.

Mandibular group

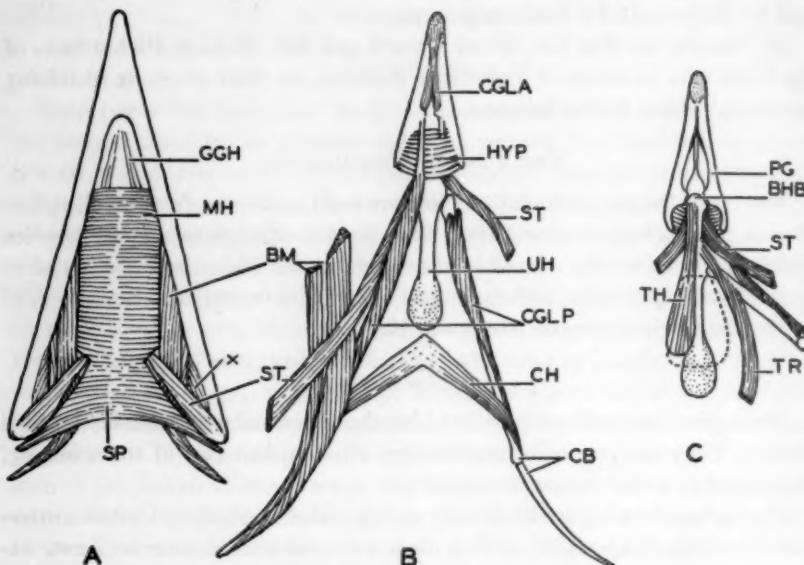
These are the muscles innervated by the mandibular branch of the fifth nerve. They are primarily masticatory muscles, but two of them belong, functionally, to the tongue musculature.

M. mylohyoideus (sic, Shufeldt; mylohyoideus anterior, Gadow; intermandibularis, Edgeworth).—This is a thin transverse muscle sheet, extending between the rami of the mandibles (Text-fig. 1A, *mh*). Fibers from the two sides blend in the midline. Posteriorly, the sheet becomes continuous with a somewhat similar muscular layer, the serpithyoideus. The fibers of the mylohyoideus arise from the mandible dorsal to the inserting fibers of the branchiomandibularis (= geniohyoideus of Shufeldt) and not ventral to them as indicated by Shufeldt (1890, p. 21, fig. 5). This latter error was accepted by Burt (1930) and made the basis of a false comparison between ravens and woodpeckers.

M. ceratohyoideus (sic, Gadow; overlooked by Shufeldt [ceratohyoideus, Shufeldt = posterior ceratoglossus]; interkeratoideus, Edgeworth).—This is a very thin, short and strap-like muscle, extending obliquely forward from the ceratobranchiale to the midline, beneath and posterior to the urohyale (Text-fig. 1B, *ch*). Its origin is from the lateral side of the proximal piece of the ceratobranchiale at its distal end around which it makes a half turn to cross over the ventral side. At its origin it is covered by the branchiomandibularis and covers the posterior ceratoglossus. The entire muscle is hidden, in a superficial dissection, by the serpithyoideus, with the deep side of which the inserting fibers of both sides fuse in a median raphe.

This is a distinct muscle, though small, and readily seen also in passerines much smaller than the Raven, but it was overlooked by Shufeldt. Gadow does not describe its innervation, but thought it was "apparently" a

derivative of the ceratoglossus peculiar to birds. Edgeworth (1935) describes its derivation from the posterior part of the intermandibular muscle sheet.



TEXT-FIG. 1.—The tongue musculature of the Raven (*Corvus corax*). A: superficial dissection, ventral view. The skin and dermal musculature have been removed; a part of the pterygoideus (jaw muscle) is seen (x). B: deep dissection, ventral view. The mylohyoideus and serphylloideus have been removed, and the entire hyoid apparatus has been separated from the mandible and floor of the mouth. The larynx, trachea and associated musculature are not shown. C: dorsal view; left side superficial, right side deep dissection. Shown in outline by the broken line is the thyroid cartilage, which lies on the dorsal side of the urohyale, and from the ventral surface of which the thyrohyoideus arises.

Abbreviations: *bhb*, basihyobranchiale; *bm*, branchiomandibularis; *cb*, ceratobranchiale; *cgl*, *cglp*, anterior and posterior ceratoglossus; *ch*, ceratohyoideus; *ggh*, genioglossus-geniohyoideus; *hyp*, hypoglossus posterior; *mh*, mylohyoideus; *pg*, paraglossale; *sp*, serphylloideus; *st*, stylohyoideus; *th*, thyrohyoideus; *tr*, tracheohyoideus; *uh*, urohyale; (x, *M. pterygoideus*).

With respect to passeriforms other than those I have examined: Moller (1931) describes a muscle in *Zosterops annulosa* (Zosteropidae) without naming or homologizing it, which, on the basis of topographical relationships, seems to be this muscle. He gives no indication of it in other passeriforms studied by him.

Hyoid group

These are the muscles primarily derived from the hyoid muscle plate and innervated by the seventh nerve. Of them, two derivatives of the constrictor colli belong, functionally, to the tongue musculature.

M. stylohyoideus (sic, Shufeldt and Gadow; gularis anterior, Edgeworth).—A long, thin, flat and tapering muscle, extending from the posterior end

of the mandible to the basihyobranchiale (Text-fig. 1, *st*). The origin is from the lateral face of the angulare, immediately anterior to the depressor mandibulae. The postero-medial edge of the muscle is closely bound to the antero-lateral edge of the serpihyoideus in this region. It then crosses the branchiomandibularis superficially, passes deep to the mylohyoideus and runs forward beside the posterior ceratoglossus, gradually crossing to its dorsal side, and acquiring a fleshy insertion along the lateral surface of the basihyobranchiale. The anteriormost portion of insertion lies between the hypoglossus posterior and the thyreohyoideus (Text-fig. 1C). Shufeldt (1890, pp. 27-28, fig. 7) was in error in describing and figuring the insertion of this muscle in the Raven as on the head of the ceratobranchiale, although such an insertion is said to occur in some passeriform birds (cf. Moller, 1930, 1931: Nectariniidae, Meliphagidae, Coerebidae, Zosteropidae).

M. serpihyoideus (*sic*, Gadow; digastric, Shufeldt; gularis posterior, Edgeworth).—A double fan-shaped muscle lying posterior to the mylohyoideus, with which it apparently is continuous (Text-fig. 1A, *sp*). It arises, on either side, by a narrow band of fibers from the basitemporal plate, medial to the depressor mandibulae. These extend ventrad between the angle of the jaw and the muscle-wound ceratobranchiale and, turning mediad, spread out in a thin sheet of superficial muscle, the fibers from either side meeting in a median raphe and blending anteriorly with those of the mylohyoideus. On its deeper surface the inserting fibers of the ceratohyoideus join the raphe.

Apparently in some passeriforms the primary origin of the serpihyoideus from the mandible, just back of the stylohyoideus, rather than from the base of the skull, is retained (cf. Moller, 1930, 1931: Nectariniidae, Meliphagidae, Coerebidae, Zosteropidae).

Note: The two muscles of this group, which in some other birds are not separate, together constitute the mylohyoideus posterior of Gadow (= the gularis of Edgeworth).

Ventral muscle group

This group of muscles is derived from the branchial muscle plates, innervated by branchial nerves of the corresponding segments. Only the subarcuales recti of the first segment (ninth nerve) are represented in birds, and these have but one derivative.

M. branchiomandibularis (*sic*, Edgeworth; geniohyoideus, Shufeldt and Gadow).—A flat, stout muscle-bundle extending from the ceratobranchiale to the mandible (Text-fig. 1 A, B, *bm*), more or less clearly separable into lateral and medial portions. It is attached to the distal unit of the ceratobranchiale which it enwinds in a spiral half-turn. Leaving the ceratobranchiale in the region of the joint between proximal and distal portions,

it passes deep to the stylohyoideus and superficial to the mylohyoideus to the medial surface of the mandible, where it attaches over an extensive area. Shufeldt's description is substantially correct, but his text-figure, previously mentioned, shows the area of attachment to the mandible as dorsal rather than ventral to that of the mylohyoideus.

Hypobranchial spinal group

These are muscles derived from the ventral ends of occipito-spinal myotomes, innervated by the cervical plexus, the major contribution to which is made by the twelfth nerve. The group becomes separated in development into prehyoid derivatives, innervated by the lingual nerve, and posthyoid derivatives, innervated by the superior descending cervical nerve. The former include the geniohyoid-genioglossus, the ceratoglossals and the hypoglossals; the latter include derivatives of the rectus cervicis.

Prehyoidean hypobranchial spinal muscles

Mm. geniohyoideus-genioglossus (*sic*, Edgeworth; *genioglossus*, Gadow; overlooked by Shufeldt [*geniohyoideus* of Shufeldt and Gadow = *branchiomandibularis*]).—These vestigial muscles are represented by a few longitudinal fibers in the anterior part of the floor of the mouth, between the oral mucosa and the mylohyoideus (Text-fig. 1A, *ggh*). In gross dissection they appear to be stringy cords diverging posteriorly from the region of the symphysis toward the medial sides of the sublingual glands, and disappearing posterior to the base of the tongue. Teased fragments, placed under the microscope, quickly reveal their skeletal muscle nature. In serial sections of the head of a nestling Brown Thrasher (*Toxostoma rufum*), I was able to follow some of the more medial fibers to the ventral side of the posterior end of the paraglossale; the remainder faded out beneath the mucosa to the side of the base of the tongue.

Moller (1930, 1931) notes the occurrence of these muscles in the following passeriforms: *Cinnyris chalybeus* (Nectariniidae); *Anthornis melanura* (Meliphagidae); and *Dacnis cayana* (Coerebidae). In each of these, insertion is on the ceratobranchiale and on the paraglossalia. In *Zosterops annulosa* (Zosteropidae) he describes muscle fibers arising from the mandible and inserting on the pharyngeal mucosa, that probably represent this muscle, which thus appears to have an arrangement in *Zosterops* similar to that in the passerines examined by me. To my knowledge there are no other reports of the occurrence of these muscles in passeriform birds.

M. ceratoglossus posterior (*sic*, Gadow; *ceratohyoideus*, Shufeldt [*ceratoglossal* of Shufeldt = ? *tracheohyoideus*]; *hyoglossus posterior* [not *hypo-*], Edgeworth).—A slim, nearly cylindrical muscle-bundle extending from the ceratobranchiale to the paraglossale (Text-fig. 1B, *cglp*), it arises from the

dorsal surface of the proximal unit of the ceratobranchiale, along most of its length; proximally, it crosses over ventrally toward the midline, becomes tendinous as it passes over the under side of the hypoglossus posterior, and is inserted on a tubercle on the ventro-medial border of the paraglossale, just in front of its articulation with the basihyobranchiale.

Shufeldt erroneously considered himself to be in agreement with Gadow in his use of the names ceratohyoideus and ceratoglossal; the error in synonymy has been carried along by Edgeworth (1935, p. 288).

M. ceratoglossus anterior (sic, Gadow; ?depressor-glossus, Shufeldt; hyoglossus anterior [not hypo-] Edgeworth).—A tiny bundle of muscle fibers within the tongue, on the under side (Text-fig. 1B, *cyla*). This vestigial muscle arises by a delicate tendon just in front of the tubercle on the paraglossale on which the posterior ceratoglossus inserts; the muscle fibers spread out anteriorly over the under side of the cartilage of the tip of the tongue.

In serial sections of the head of a nestling Brown Thrasher (*Toxostoma rufum*) it may be seen that the point of origin of this muscle is 0.5 mm. anterior to the insertion of the (posterior) ceratoglossus; between the two is a marked localized thickening of the perichondrium of the paraglossal cartilage. It is precisely as though the inserting tendon of the ceratoglossus fused to the perichondrium for a short distance, then separated, became carneous, and continued on to the tip of the tongue. The evidence thus indicates that this tiny muscle on the under side of the tongue is a separated anterior portion of the ceratoglossus, such as has previously been reported to occur in *Gallus*, *Procellaria*, and *Palamedes* (Gadow, Edgeworth).

In two of the four passeriforms whose tongue musculature was studied by Moller (1931: *Dacnis cayana*, *Zosterops annulosa*) he mentions the occurrence of "Skelettmuskeln" around the paraglossalia, which he saw in sections of the tongue. These, possibly, represented the ceratoglossus anterior; otherwise, there has been no report of the occurrence of this muscle in passeriform birds.

The depressor-glossus of Shufeldt, according to him (1890, p. 30), "arises fleshy [in the Raven] from the entire under surface of the [basihyobranchiale], the fibers contract as they pass forwards, and become tendinous between the [paraglossalia], and as a delicate tendon so continue on to finally find an insertion at their tips, where they meet anteriorly (Fig. 17)." The fact is that there is no muscle in the Raven which answers this description, or which occupies the position of the muscle shown in his fig. 17 (p. 46). No muscle extends from the ventral surface of the basihyobranchiale to the paraglossalia. The ventral surface of the former is a thin keel, bare of muscle; the lateral faces are covered by the stylohyoideus. Except for the posterior ceratoglossus, which Shufeldt, under the name "ceratohyoideus," correctly described and figured, the only other muscle in this general region

is the hypoglossus posterior. But this is a *transverse*, rather than a longitudinal muscle such as shown by Shufeldt, and of such a nature that he could not have failed to recognize it, had he seen it.

M. hypoglossus posterior (*sic*, Edgeworth; *hypoglossus obliquus*, Gadow; overlooked by Shufeldt).—An apparently unpaired, transverse muscle, passing beneath the basihyobranchiale between the posterior ends of the paraglossalia (Text-fig. 1B, *hyp*). The anterior ends of the stylohyoideus are covered by the muscle, while the tendons of the posterior ceratoglossus pass over its ventral surface. Undoubtedly originating from paired primordia, the fibers coming from either side do not form a raphe, but overlap one another to form a continuous muscle extending from one paraglossale to the other. The muscle lies back of the joint formed by the basihyobranchiale with the two paraglossalia; contraction, therefore, would pull the posterior ends of the paraglossalia downward, and, consequently, elevate the tip of the tongue. If synergistic muscles (the two sets of ceratoglossals) opposed this action, then, conceivably, contraction of the hypoglossus could arch the dorsal surface of the tongue by depressing its edges.

Apparently, this conspicuous muscle has not previously been reported to occur in passeriform birds. In *Dacnis cayana* (Coerebidae), Moller (1931) describes and figures a muscle which probably is this; he does not give it a name. Apparently it is absent in the nectariniid, meliphagid and zosteropid species studied by him, since, although he examined sections of the tongue, he makes no mention of a muscle which could be interpreted as the hypoglossus posterior (Moller, 1930, 1931).

Posthyoidean hypobranchial spinal muscles

These are the derivatives of the *rectus cervicis* (system of the sternohyoideus, Gadow) which forms two bands, an external and an internal fasciculus. The former is attached posteriorly to the tip of the keel of the sternum (= cleidotrachealis of Shufeldt). About the middle of the neck it is tightly bound to the skin, becomes free again and passes forward at the side of the trachea, to the anterior end of which it is more or less firmly attached. A pair of muscle bundles which appear to be the direct continuation of this fasciculus reach the hyoid apparatus. They are, therefore, the equivalent of the *cricohyoideus* of Edgeworth; for convenience in description the separate names employed by Gadow will be used here.

M. tracheohyoideus (Shufeldt: ? *ceratoglossal*, in part).—A flat muscular band extending from the latero-ventral side of the trachea to the dorso-medial face of the head of the ceratobranchiale; a few fibers continue on to the lateral face of the basihyobranchiale beneath the *stylohyoideus* (Text-fig. 1C, *tr*). This muscle is a continuation of the outermost part of the external fasciculus of the *rectus cervicis*.

M. thyrohyoideus (Shufeldt: sterno-hyoideus; ? ceratoglossal, in part).—This muscle extends from the thyroid cartilage of the larynx, over the head of the ceratobranchiale, to the dorsal surface of the basihyobranchiale, reaching to its very tip (Text-fig. 1C, *th*). Wide posteriorly, where it covers the ventro-lateral half of the thyroid cartilage, it narrows abruptly as it passes forward. Shufeldt's figures of these two muscles (his ceratoglossal and sterno-hyoideus) are puzzling. I am unable to reconcile them with the facts. No part of the rectus cervicis extends anteriorly *beneath* the ceratobranchiale, as shown in his ventral view (Fig. 17, p. 46, sterno-hyoideus); while the basihyobranchial attachment of his muscle extending forward from the ceratobranchial (Fig. 18, p. 35, ceratoglossal) occupies the actual area of attachment of the muscle extending forward from the ventral face of the thyroid cartilage.

SUMMARY

The musculature effecting movement of or in the hyoid apparatus, here termed "tongue musculature," was dissected in nineteen species of the following passerine families: Corvidae, Troglodytidae, Mimidae, Turdidae, Laniidae, Icteridae and Fringillidae. Some differences in detail were noted, but the number and general arrangement of the muscles were uniform in all species examined. The detailed description of these muscles is given for the Raven (*Corvus corax*); eight major errors in Shufeldt's 'Myology of the Raven' are corrected.

Three of the eleven muscles herein described have not been reported previously to occur in passerines (*ceratohyoideus*, *ceratoglossus anterior*, *hypoglossus posterior*); a fourth muscle (*geniohyoideus-genioglossus*) has heretofore been reported for but three forms.

The *geniohyoideus-genioglossus* is vestigial in passerines. The *ceratoglossus anterior*, differentiated off from the rostral end of the main body of the *ceratoglossus*, is minute (probably vestigial). The *hypoglossus posterior* is a transverse muscle in these passerines; its topographical relations are such that it could act either to elevate the tip of the tongue, or, with synergists, to arch the upper surface of the tongue both transversely and longitudinally.

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NUMBER OF FEATHERS AND BODY SIZE IN PASSERINE
BIRDS

BY F. B. HUTT AND LELAH BALL

OTHER things being equal, the amount of heat lost by a warm-blooded animal is directly proportional to the surface area of that animal. The surface area, however, is not directly proportional to the weight, but varies approximately as does weight^{2/3}. This means that the surface area per unit of weight is much greater in the small animal than in the large one, and *ipso facto*, that in homoiothermic animals the problem of maintaining body temperature above that of the environment is more difficult for small individuals than for large ones. Kleiber (1932) calculated that if a mouse and a steer had the same heat production per gram of body weight, and if both were required to maintain the same temperature, the mouse would need a specific insulation twenty times that of the steer.

The extensive data of Wetmore (1921), including 1,558 records of body temperature for 327 species of birds, indicate that small birds maintain temperatures just as high as those of larger species. For example, the mean temperature in ten species of Paridae (tits and chickadees) was 107.9° F., exactly the same as for fourteen species of Corvidae (jays, magpies and crows).

Determinations of the metabolic rates of forty-five birds representing thirty-two different species ranging in size from 0.02 to 17.6 kilograms, made by Benedict, Giaja, Terroine and others, as summarized by Brody (1932, pp. 89-97), show that in birds, as in mammals, the metabolism per unit of body weight is highest in the smallest species and decreases with increasing body size. This indicates that maintenance of high temperatures by small birds is accomplished in part by an increase in the metabolic rate. However, the amount of insulation may also be an important factor. If this be so, the greater insulation needed by the smaller birds to maintain temperatures the same as those of large ones, which are from 3° to 12° F. higher than those of mammals, might be obtained by increased length of the feathers, but the resultant disproportion between size of body and length of feathers would probably interfere with flight and hence have little 'survival value.' Since the type of feather changes little within any one order, or group of birds, it is probable that any additional insulation needed by small birds is provided by an increase in the number of feathers per unit of body surface. On theoretical grounds, therefore, there should be many more feathers *per unit of area* in the Chickadee weighing eight to ten grams than in the Blue Jay of about ten times the latter weight. It follows that, since the surface area per unit of weight increases with diminishing body

size, there should be a still greater difference between the Chickadee and the Blue Jay, with respect to the number of feathers *per unit of body weight*. On this basis a fairly consistent increase in the number of feathers per gram of body weight is to be expected in progressing from the larger to the smaller species within a group of related birds.

MATERIAL

Data have recently been provided by Wetmore (1936) with which the validity of this hypothesis can be tested. Actual counts of contour feathers are given for 152 birds, and for 101 of these there is also given the weight of the bird on the day it was collected. All but four of these 101 belong to the Passeriformes. This one order thus provides for analysis 97 determinations on a group of birds similar in form and homogeneous with respect to many characteristics, but with a range in size from 5.5 grams in a Golden-crowned Kinglet (*Regulus satrapa*) to 117.7 grams in a Purple Grackle (*Quiscalus quiscula*).

Since sex dimorphism in size is not extreme in this order, little error is incurred by disregarding sex in the analysis. Wetmore points out that counts of feathers were in general lower in late spring and early summer than at other seasons, but owing to the comparatively small number of determinations available for analysis and the fact that these were distributed from February to October, it has not been possible in this study to correct for changes with season. This source of error would be most serious if large birds were collected at one season and small species at another. This was not the case. The determinations were well distributed throughout the year, not only in the whole series, but also in the many species having feather counts for several birds.

ANALYSES

A. Passeriformes

No attempt has been made to relate the number of feathers to surface area by using the von Meeh formula for determining surface from weight. Brody (1932, p. 11) showed that determinations of surface area for one species by different investigators may differ by more than sixty per cent. Since the birds considered here vary greatly in size it is doubtful if any one value for the species constant (*k*) in the formula would be justifiable. Giaja (1925) determined *k* as 7.4 for a finch, 8.69 for a shrike, and from 6.54 to 11.5 for chickens of different sizes. For these reasons the numbers of feathers in birds of different sizes have been considered in relation to body weight.

On plotting the data it was found that they conform to the general equation $y = ax^n$, where y = number of feathers, x = body weight in grams

and a and n are constants. After fitting the data to this equation by the method of least squares, the values of these constants were found to be $a = 910.17$ and $n = 0.185$. The curve for the distribution of feathers in relation to body weight is therefore:

$$y = 910.17 x^{0.185}.$$

For twenty-nine warblers (Mniotiltidae) representing twenty species, the distribution follows the curve $y = 861.54 x^{0.2361}$ and for twenty-four sparrows (Fringillidae) of twenty species the corresponding curve is $y = 747.86 x^{0.226}$. The warblers evidently have denser plumage than the sparrows but the change with size of bird, as indicated by the exponent, is apparently very similar in both families.

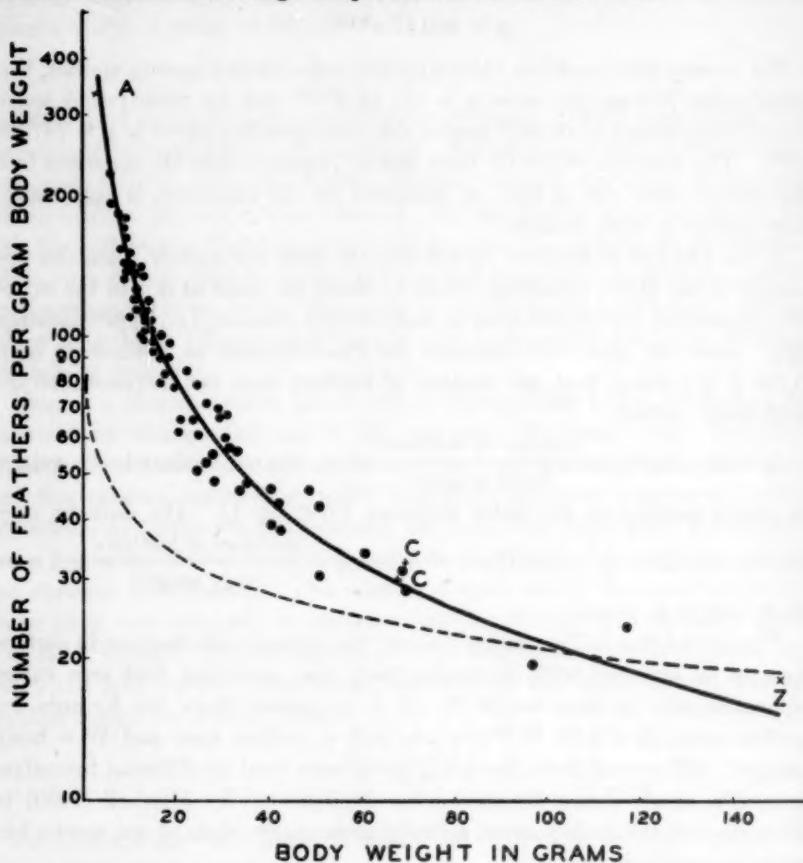
If the number of feathers varied directly with the surface, then the exponent in the above equations would be about the same as it is in the equation expressing the surface area to body-weight relation, i.e., approximately $2/3$. However, since the exponent for Passeriformes as a whole is only 0.185 it is evident that the number of feathers does not increase directly with body surface.

Actually the ratio $\frac{\text{number of feathers}}{\text{body weight}}$ when plotted against body weight in grams declines as the latter increases (Text-fig. 1). The data fit very closely the curve: $y = 910.17 x^{-0.185}$ where $y = \frac{\text{number of feathers}}{\text{body weight}}$ and $x = \text{body weight in grams}$.

The dotted line in Text-figure 1 shows the approximate increase in surface area to be expected with decreasing body size, assuming that area varies approximately as does weight $^{2/3}$. It is computed from the formula for surface area, $S = 8.19 W^{.705}$, in which S = surface area and W = body weight. (Of several formulae which have been used by different investigators, this one is chosen because it has been proven by Mitchell (1930) to fit quite well the surface areas actually measured in birds of one species but varying greatly in size.)

If the increase in number of feathers per gram of body weight with decreasing size were attributable solely to the associated and inevitable increase of surface area (with number of feathers per unit of area remaining constant) then Wetmore's feather counts should be grouped along a curve of the shape of the dotted line in Text-figure 1. Actually the number of feathers per gram of body weight increases much more rapidly than surface area. In only five cases out of 97 does the ratio deviate by more than 20 per cent from the theoretical expectation based on the equation for the solid line, given above. It is evident, therefore, that in the Passeriformes the increase in the number of feathers per unit of body weight is much greater

than could result solely from the increase in surface area per unit of weight and that there must be a consistent increase in the number of feathers per unit of area with decreasing body size. This probably indicates an adaptation for maintenance of high temperature in the smaller birds.



TEXT-FIG. 1.—Relations between body size and (a) number of feathers (solid line) and (b) surface area (broken line) per unit of body weight in the Passeriformes, both plotted on a semi-logarithmic grid. Each dot represents a count of feathers on one bird except in species smaller than 20 grams where, to avoid crowding, one dot shows the average for one to four individuals. The scale on the ordinate for the broken line must be divided by 10 to show the number of square centimeters per gram of body weight. Non-passserine birds are shown at A (*Archilocheus colubris*), C (*Chordeiles minor*) and Z (*Zenaidura macroura*).

B. Other Orders

Some indications that this principle might apply equally well to some non-passserine species is provided by the four such birds for which Wetmore gives both feather count and body weight, and also to a lesser degree by

Ammann's (1937) swan (Table 1). For these birds the expected ratios of feathers/weight have been calculated by determining for the given body weight the corresponding value of y in the equation used for the Passeriformes, $y = 910.17 x^{-0.318}$. The actual determinations, with the exception of that for the swan, are shown in Text-figure 1 at A, C, and Z. It is quite evident that, with the exception of the swan, these birds conform closely to the curve established for the Passeriformes. This is all the more remarkable because one would not expect single determinations, like those for the hummingbird and Mourning Dove, to conform to the rule as closely as would the average of several determinations for a species.

TABLE 1
Application of the equation for the feathers/weight ratio in Passeriformes to birds of other orders

Order and Species	Feathers No.	Body weight grams	Ratio: Observed	No. of feathers Body weight Expected
MICROPODIFORMES				
Ruby-throated Hummingbird, <i>Archilochus colubris</i>	940	2.8	335.71	393.23
CAPRIMULGIFORMES				
Eastern Night-hawk, <i>Chordeiles minor</i>	2265	69.3	32.68	28.76
Eastern Night-hawk, <i>Chordeiles minor</i>	2034	67.9	29.96	29.24
COLUMBIFORMES				
Mourning Dove, <i>Zenaidura macroura</i>	2635	152.7	17.26	15.03
ANSERIFORMES				
Whistling Swan, <i>Cygnus columbianus</i>	25216	6123.0	4.12	0.75

The excess of feathers above the theoretically expected number in the swan is not surprising because of the elongation of the neck, a densely feathered region in this species. Ammann's data show that 80 per cent of the swan's feathers are on the head and neck. Presumably the values of k and n in this equation should be somewhat different in Anseriformes from those applicable in Passeriformes and other birds like them.

DISCUSSION

Wetmore (1936) points out that the hummingbird had the smallest number of feathers of all the species counted and that such a condition was to be expected, since it was the smallest of all birds examined. It seems equally noteworthy that in this diminutive species the number of feathers per gram of body weight (and presumably, therefore, the insulation) is greater than in any other of the sixty-six species for which data are available. It would be of interest to know if the northward-ranging Ruby-throated Hummingbird carries more feathers per unit of weight than those members of its family which remain in the tropics. On theoretical grounds one would expect fewer feathers in the latter.

In the curve expressing for Passeriformes the change in the ratio feathers/weight, the exponent is $-.815$. This curve is satisfactory for representation of three other Orders. In the corresponding curves for warblers and for sparrows the exponent is $-.764$. It seems justifiable to formulate the following general rule:

The number of contour feathers per unit of body weight (y) increases with decreasing body weight (x) according to the relation $y = ax^{-n}$, in which the values of n thus far determined are of the order of 0.8.

The finding that the number of feathers per unit of body weight increases with decreasing body weight is in accordance with the original hypothesis that small birds need more insulation than large ones if both groups are to maintain the same body temperature. It would appear to indicate a special adaptation for conservation of heat in the smaller species. However, since the general tendency is for the smaller birds to have higher rates of metabolism, it is probable that both adaptations contribute to the maintenance of high temperatures.

It is beyond the scope of this paper to determine the relative importance of these two influences, but the importance of the plumage and retention of the heat produced are indicated by recent studies of the physiology of birds lacking normal plumage. It was shown by Hutt (1930) that fowls homozygous for the frizzing mutation have defective plumage and may become practically bare when defective feathers break off. According to Benedict, Landauer and Fox (1932) such birds have abnormally high rates of metabolism, and, associated with it, a lack of fat deposits, enlarged thyroids, increased heart rate, hypertrophy of the heart, decrease of hemoglobin and frequent sterility. These conditions are decidedly not conducive to the survival of a species so affected, either in domestication or in Nature. It seems probable, therefore, that while the temperature of the smaller birds is maintained in part by an increase in the rate of metabolism, any adaptation for more efficient retention of the heat produced is equally important, if not more so. The inverse relationship between the number of feathers and body size provides exactly such an adaptation.

It would be of interest to know how closely this rule applies to variations in size within a species such as the Domestic Fowl, where mature males may weigh, according to the senior author's determinations, from 550 to 4970 grams in different breeds. Equally interesting would be tests of its validity in aquatic species and in the Ratites which, because of lack of barbules, have a somewhat unusual type of plumage.

SUMMARY

Analysis of Wetmore's counts of contour feathers in ninety-seven birds of the order Passeriformes shows that the number of such feathers per unit of

body weight (v) increases with decreasing body weight (x), according to the relation $y = ax^{-n}$, where $a = 910$ and n approximately 0.8. In spite of seasonal variation, in only five cases out of ninety-seven did the number of feathers per gram of body weight deviate by more than 20 per cent from the numbers calculated from body weight with this equation. In warblers (Mniotiltidae) the plumage was slightly denser than in sparrows (Fringillidae). Feather counts for representatives of three other orders fitted closely to the numbers computed from the equation for Passeriformes. It is concluded that while the increased metabolism of smaller birds is instrumental in their maintenance of high temperatures, the rapid increase in the number of feathers per unit of body weight with decreasing size of bird is an adaptation for retention of the heat produced.

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A FACIAL ANOMALY IN A PHEASANT

BY ROBERT M. STABLER

INTRODUCTION

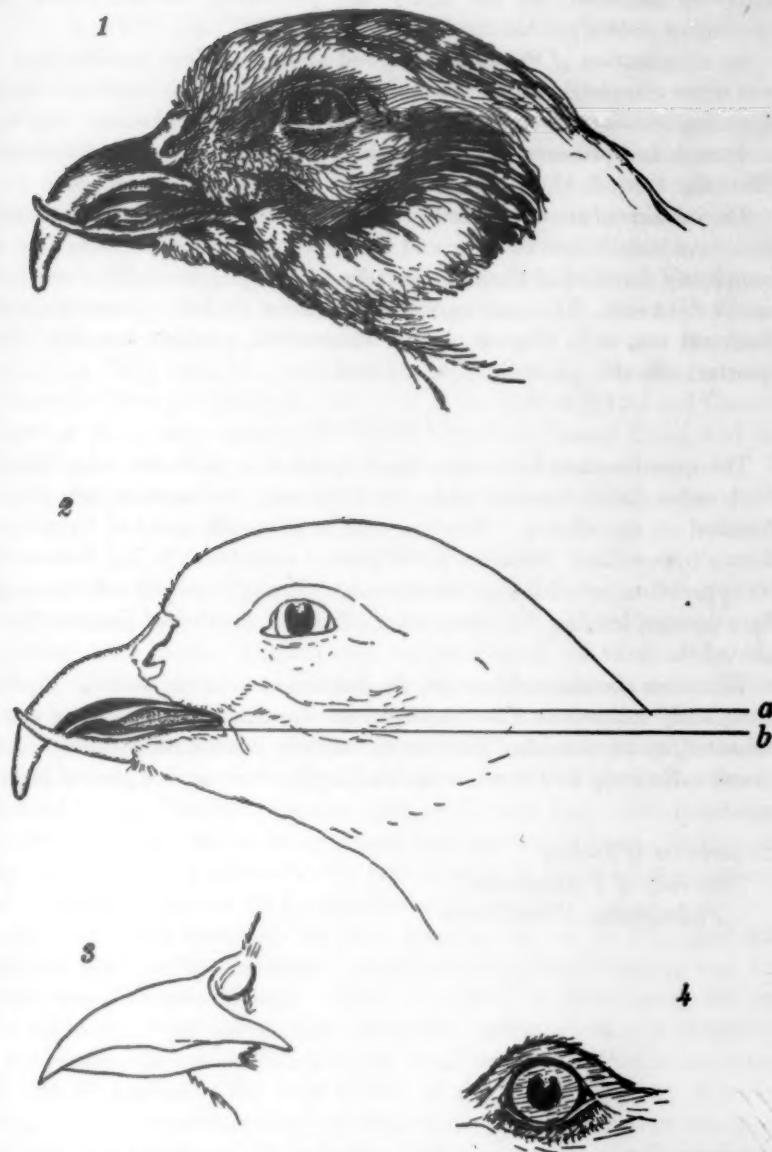
ADJUSTMENTS to accidental mutilations must be much more common in Nature than we realize. The writer has seen wild rabbits with individual feet missing, rats and mice in the same predicament and birds with only a stump where a leg should be. Undoubtedly the reader can likewise recall having seen a wild animal, living apparently happily in its environment, minus an ear, an eye or a leg.

Without going into the literature, it is the writer's desire to present the case of an adult female Chinese Ring-necked Pheasant, *Phasianus torquatus*, collected on March 14, 1938, in Wallingford, Pennsylvania, as part of a survey for protozoan parasites. The condition of this bird, with mandibles permanently crossed and showing other evidences of a serious accident, followed by adjustment, seemed worthy of a note.

The writer wishes to thank Mr. Conrad Roland for the excellent drawing of the head (Text-fig. 1, no. 1). He also wishes to thank Mr. Rodolphe M. De Schauensee of the Philadelphia Academy of Natural Sciences for the use of normal specimens of female Ring-necked Pheasants from the Academy's collection.

OBSERVATIONS

The pheasant, except for the head region, was apparently a perfectly healthy bird, fat and with a full crop at the time of collection (5.00 p. m.). An examination of the head revealed, first, a pair of irreversibly crossed mandibles, the lower one extending beyond and to the left of the upper (Text-fig. 1, no. 1). These mandibles, having no opposing surfaces to wear them away, had apparently grown almost uninterruptedly at the distal ends. Measurements of the beaks of four normal female birds of the same species showed the following. The average length of the upper mandible from the base of the nares along the curvature to the tip was 20.6 mm., while that for the lower, from the tip back to the feathers of the chin, was 12.0 mm. The corresponding measurements for the present bird were 29.0 and 19.0 mm., respectively. Furthermore, the left side of the upper mandible was considerably worn by the vertical movement of the lower, presumably in eating, while the right side had grown down much lower than normal. Also, most of the mass of the lower mandible had been lost, as it measured only 4 mm. in width half-way out its length, as compared to nearly 10 mm. in the normal bird. The function of the lower mandible was likewise



TEXT-FIG. 1.—Numbers 1 and 2 represent side views of the maimed pheasant; *a* is the bare area on the cheek, *b* is the hardened tip of the tongue. Numbers 3 and 4 represent a normal beak and eye, respectively.

markedly impaired, for the injury had prevented the bird's ever fully opening or closing the mouth.

An examination of the tongue showed another curious modification. It was never completely inside the mouth and, due either to continued friction in eating or to exposure, or both, the distal portion had become very hard and tough and presented the appearance of a thickened, warty termination (Text-fig. 1, no. 2, *b*).

The left side of the cheek itself was also somewhat involved in the mutilation. An area below the eye and just back of the angle of the jaw was completely denuded of feathers (Text-fig. 1, no. 2, *a*), a condition not found on the right side. The muscles of the lower lid of the left eye were somewhat damaged too, and, whereas closure was normal, opening was only three-quarters effective (Text-fig. 1, nos. 1 and 2).

DISCUSSION

The question that first comes to one's mind is, How and when did this bird suffer its disfiguring mishap? Obviously the answer can only be founded on speculation. Was the bird in its youth grabbed by a hawk? Bitten by a snake? Mangled in the jaws of a steel-trap? Did Nature alter its appearance before it ever left the egg? Or was it accidentally fired upon by a hunter, leaving the devastating effects of a string of shot on the left side of the face?

Whatever the cause, however, the important point is that the bird had completely compensated for its affliction. Despite its partly closed eye, its scissored, much restricted jaws, it successfully evaded its enemies, fed and drank sufficiently well to maintain itself in the most perfect general physical condition.

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A NEW EASTERN RACE OF THE CANADA GOOSE

BY W. E. CLYDE TODD

FOR a number of years the Carnegie Museum has been amassing material for a critical study of the Canada Goose (*Branta canadensis*) in connection with a biological investigation of the Labrador Peninsula and other parts of Canada. The potential results indicated by our series of specimens were in a large measure anticipated by Mr. Percy A. Taverner in his study of this species (Bull. Nat. Mus. Canada, no. 67, pp. 30-40, 1931). But the subject, admittedly, was by no means exhausted, and Mr. James Moffitt, of the California Academy of Sciences, is now at work on a new revision of this group. His researches are based on the examination of a large amount of material from the principal collections in the United States and Canada. Together we recently examined our series of eastern Canada Geese, and Mr. Moffitt has verified my early suspicion that more than one race exists. At his suggestion, therefore, I am presenting a brief résumé of the case with a description of the new race.

Our concept of this group was decidedly clarified by Taverner's paper above cited. His study was based on breeding specimens, a list of which he gives under each form. Since apparently he had no breeding specimens whatever from eastern Canada and Newfoundland, his diagnosis of and remarks upon typical *canadensis* refer solely to examples from inland and western localities. This is unfortunate, because the Canada Geese which migrate along the Atlantic coast and breed in Newfoundland and Labrador are not the same (taxonomically speaking) as those which migrate through the interior and breed on the east coast of Hudson Bay. The former are light-colored birds; the latter by comparison are dark-colored. It is necessary at this point to determine the type locality of the original *canadensis* and to allocate properly its Canada Goose population.

Anas canadensis Linnaeus (Systema Naturae, ed. 10, 1: 123, 1758) was based on the "Anser canadensis" of Willoughby, Ray, Catesby, and Edwards—the "Canada Goose." The "Canada" of these early authors referred to the French settlements in the St. Lawrence valley with Quebec as the center. Hence (as in analogous cases) we are justified in accepting the City of Quebec as the type locality of the present species. Whether this goose bred there formerly is questionable; at any rate, it occurs there now only as a transient. We have available three spring (April) specimens from this locality; they are clearly referable (as might be expected on geographical grounds) to the Atlantic coast form, although they show some intermediate tendencies. With this point settled, the way is open to separate the other form as

***Branta canadensis interior* subsp. nov.**

Type, No. 107,961, collection Carnegie Museum, adult male; Port Harrison, Hudson Bay (east coast), northern Quebec, May 26, 1930; W. E. Clyde Todd (No. 3140).

Subspecific characters.—Similar to *Branta canadensis canadensis* Linnaeus of the Atlantic coast region, but general coloration darker; upper parts darker, more grayish brown; and under parts also darker (between 'light drab' and 'light mouse gray'), deepening on the flanks.

Measurements of type.—Wing (greatest length, flattened), 483 mm. (chord, 465); tail, 148; exposed culmen, 56; tarsus, 93. Number of rectrices, 18.

Range.—Breeds on the east coast of Hudson and James Bays, and migrates southward in the winter to the southern States (mainly west of the Appalachian chain).

Remarks.—Typical *canadensis*, as represented by breeding examples from Newfoundland and by winter birds from the South Atlantic coast, is a comparatively light-colored bird. In breeding dress the anterior under parts are buffy white, and this pale color runs up on the sides of the lower neck (behind the black) to form a conspicuous light-colored area on the upper back. In the new race this feature is wanting. The feather-edgings in the new race are generally darker, while the under-plumage is conspicuously so. There is, of course, some individual variation, but the differences here pointed out are sufficiently constant in specimens of the same season and age. They are perfectly obvious in juvenal dress, as shown by a comparison of July specimens in that stage from Newfoundland with those from South Twin Island (James Bay).

Our twelve specimens of *interior* are summer and fall birds from the east coast of Hudson and James Bays, as well as from the south coast of the latter, an undoubtedly breeding station. The Twin Islands in northern James Bay are a well-known breeding resort. How far back from the coast this form ranges is not known, but probably it extends to the height of land, where it should intergrade with true *canadensis*. The indications are that the latter form ranges northward through eastern Labrador as far at least as the head of Ungava Bay, as shown by a specimen (not quite typical) in the Carnegie Museum collection taken at the mouth of the Koksoak River in September. However, a juvenal specimen from the Swampy Bay River (in the *interior*) seems referable to the darker-colored race, and two of three fragmentary adult specimens (heads and necks only of flightless breeding birds) from the same stream are intermediates toward *canadensis*. Thus the exact range and relationships of the two races of the Canada Goose in the Labrador Peninsula still remain to be worked out.

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A NEW GENUS AND SPECIES OF MEXICAN FLYCATCHER

BY JOHN T. ZIMMER

FOR a number of years I have had in my study a specimen of a flycatcher from Mexico that has been a source of much speculation and considerable study. I have shown it to various visitors at different times and have written to Dr. Hellmayr for possible information he might have on some other specimen of similar identity, but up to date I have not been successful in finding anything which throws any light on this bird. It was originally identified as *Myiochanes richardsonii* and is labeled as that form. I discovered it in a tray of *Empidonax trailli*. Actually the bird has no close relationship to either of these genera, nor does it appear to be referable to any other genus of the Tyrannidae. Probably its nearest relative is *Xenotriccus* of Guatemala, but that relationship is not close enough to warrant placing the Mexican bird in that genus.

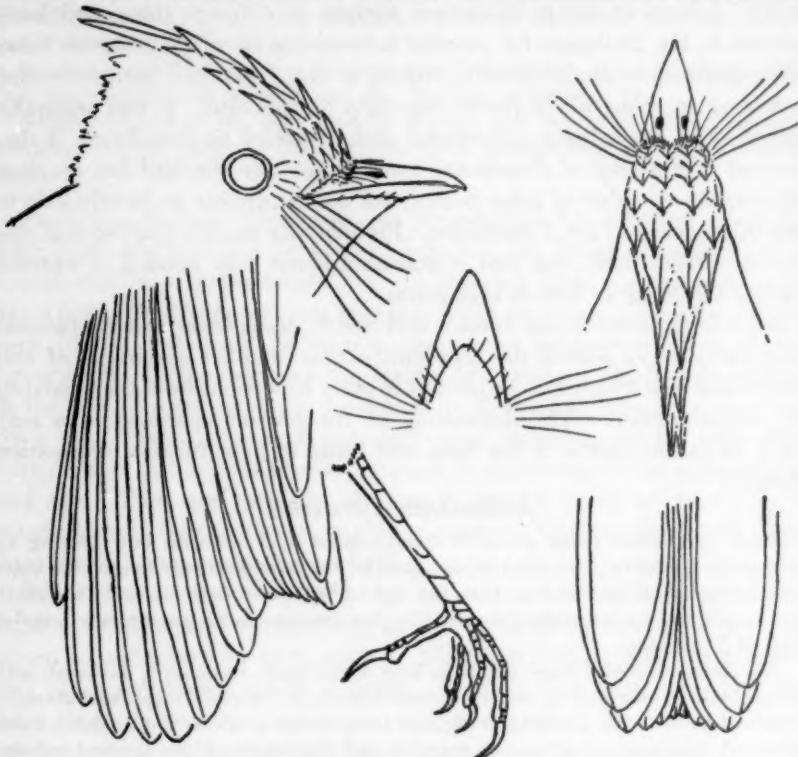
Superficial resemblances in color and size to *Myiochanes* and *Empidonax* may easily have caused the misidentification of other specimens of this interesting bird which may be present in other collections from the highlands of central Mexico. The description of the present specimen thus may serve to call attention to the form and bring to light further information about it.

***Aechmolophus* new genus**

Small Tyrannidae (wing about 70 mm.) related to *Xenotriccus* but differing by having the bill flatter, the rictal bristles shorter, the crest decidedly longer, the outer (tenth) primary longer (shorter than the second but longer than the first), the ninth also longer, and the tail slightly shorter than the wing and much less strongly rounded than in *Xenotriccus*.

Bill (from concealed base) about as long as the head, moderately flattened, with lateral outlines very slightly convex; culmen slightly, not sharply, ridged and abruptly decurved at tip, with a small but distinct subterminal notch on the tomium; width of bill at posterior end of nostrils equal to half the length of the exposed culmen; width of bill at base equal to the length of the gonys and just over half the length of culmen from concealed base; exposed culmen shorter than middle toe with claw and longer than outer toe with claw; nostrils oval, quite exposed except for overhanging bristles, without a distinct fossa but with a narrow superior membrane and a short (basal) inferior one; position of nostrils midway between culmen and tomium and midway between concealed base and tip of maxilla; mandible more flattened than maxilla and different in color. Feathering on top of head with acute tips, forming a greatly elongated crest, the longest feathers of which spring from the posterior part of the forehead and reach to the anterior part of the mantle; feathering of point of chin, lores, and post-nasal region strongly bristly. Tarsus long and moderately strong, one and one-half times as long as the middle toe with claw; not perfectly exaspidean since the scutes on the basal end of this member do not reach the posterior margin where there are suggestions of a second row of scales (this condition is more marked in *Xenotriccus* where the posterior edge of the basal half of the tarsus has a row of broad but rather well-defined scales, quite distinct from the anterior

row); middle toe fused to outer toe for most of the basal joint; hind toe with claw slightly shorter than middle toe with claw. Wing and tail of nearly equal length, the wing slightly longer; wing rounded, with outermost primary (tenth) longer than the first, shorter than the second, and 12 mm. shorter than the longest; ninth longer than the fourth, eighth longer than the fifth, sixth and seventh subequal and longest; longest secondaries 9.5 mm. shorter than the longest primaries, 3 mm. longer than



TEXT-FIG. 1.—Characters of *Aechmolophus mexicanus*. $\times 0.7$.

the shortest (first) primary. Tail slightly double-rounded; outermost pair of rectrices 4 mm. shorter than the longest pair, 3 mm. shorter than the middle pair. General plumage full; coloration rather dull brown and yellowish white.

The wing-formula suggests *Cnemotriccus* as do some other proportions, but the bill of the present genus is flatter, less ridged on the culmen, more convex in lateral outline, and with more exposed nostrils. Relationship to *Cnemotriccus* may, however, be indicated.

***Aechmolophus mexicanus* new species**

Type, No. 428,549, American Museum of Natural History, from Cuernavaca, Mexico, altitude 5000 feet. Adult male, collected April 9, 1908, by Austin Paul Smith; original No. 9931.

Diagnosis.—Superficially somewhat similar in general appearance to *Contopus cinereus brachytarsus* of Central America but differing in having the crest very much

longer, the sides of the head grayer, the throat and breast less deeply yellow, the pale wing-bars stronger (crossing both webs of the coverts at their tips), the under wing-coverts paler and more yellowish, the eye-ring uninterrupted, the outer margin of the outermost rectrices distinctly pale, the tail nearly as long as the wing, and the bill narrower and less sharply ridged on the culmen and with the nostrils more exposed, the wing much more rounded, and the tarsi much longer.

Range.—Known only from Cuernavaca, Mexico.

Description of Type.—Forehead grayish brown with narrow whitish or yellowish lateral margins; rest of forehead and central part of crown dusky brown with traces of paler and more grayish margins; feathers progressively more elongate back to an imaginary line across the anterior third of the orbits where the median feathers are 22.5 mm. in length (30 mm. from exposed base of culmen), forming a very strong, pointed crest (the feathers of the entire crest from the forehead to the crown are sharply pointed and the longer ones rather lanceolate, but a certain amount of this may be due to abrasion which may also have shortened the crest somewhat); from the center of the crown to the occiput, the feathers progressively shorten and reduce the crest to normal plumage which is, however, particularly full, like the rest of the body plumage; lores and post-nasal feathering whitish with strong, black bristles; a very narrow but complete ring of whitish around the eye; malar region dull grayish brown; auriculars somewhat buffy brown; sides of crown and occiput, postocular region, sides of neck, and hind neck dull grayish brown; mantle dull, light brown (darker than 'light brownish olive'); lower back, rump, and upper tail-coverts a little paler. Chin whitish, with black, bristly tips on anterior margin; throat with a faint tinge of light yellow; breast and sides dull, tinged with brownish, forming a not very conspicuous pectoral band; belly, flanks, and under tail-coverts pale 'Marguerite yellow'; thighs brownish. Wings 'hair brown'; primaries with narrow whitish outer margins; secondaries with pale outer margins stronger but not reaching tips of the wing-coverts, thus leaving a dark basal patch; tips of secondaries more broadly whitish; tertials with pale outer margins; greater and median upper wing-coverts dusky brown, with rather broad, dull-whitish tips (across both webs), forming two conspicuous wing-bars; lesser coverts colored like the mantle; under wing-coverts and axillars 'Marguerite yellow'; inner margins of remiges narrowly pale, dull yellowish, not reaching the tips of the feathers. Tail 'hair brown,' with outer margins of outer rectrices narrowly whitish and with suggestions of pale tips on all of the feathers; inner margins of rectrices (except middle pair) narrowly and inconspicuously paler. Maxilla dark brown; mandible dull yellowish; feet dark brown.

Wing, 70.5 mm.; tail, 69.5; exposed culmen, 11.3; culmen from base, 15.5; tarsus, 18.

Remarks.—The general appearance of *Aechmophorus mexicanus* is so plain and lacking in distinctive pattern that at first glance it might be confused with one of various small and dull-colored members of the family Tyrannidae. The extremely long and pointed crest, however, at once marks the bird as unusual and a closer examination reveals the combination of characters that prevents association with any of the known genera.

It is hoped that future collecting will produce additional specimens of this curious species if, indeed, examples are not already preserved under wrongly applied names.

American Museum of Natural History
New York City

GENERAL NOTES

Holboell's Grebe and American Brant in Wisconsin.—On April 22, 1938, a mated pair of Holboell's Grebe (*Colymbus grisegena holboelli*) was found on Fish Lake in Dane County, Wisconsin. The birds were observed with a nine-power binocular for an hour on and near a nesting site on this day and the one following. They were observed in the mating act on the nest site and were heard calling as they swam in the vicinity on both days. They added and arranged nesting material brought up from dives in shallow water. On the forenoon of April 24, the lake was visited again in company with Mr. Edward Ochsner of Prairie du Sac. Both birds were observed and the nesting site was visited in a rowboat with Mr. Ochsner. The platform of mud and decaying vegetation was about two inches above the water level and flattened but no eggs were found as it was apparently uncompleted. No opportunity was afforded to visit the lake again until the forenoon of May 12, when one bird was observed in the vicinity of the nest. In the forenoon one bird was observed sitting on a new nest site. Both birds were seen swimming together and calling after which one of them returned to the nest. On May 13, the new nest was examined from a rowboat with Mr. Ochsner and found to contain four large eggs in a shallow cupped nest about four inches above water level. Both birds stayed in the vicinity and called. The lake was visited again on May 17 in the forenoon and the birds were observed for about an hour. Approach on land caused the bird to leave the nest; and after the two birds had remained together a short time, the other bird approached and then sat on the nest.

Kumlien and Hollister in 'Birds of Wisconsin' (1903) state that Holboell's Grebe probably nested in Wisconsin. The writer is not familiar with any nesting record published since that date.

An American Brant (*Branta bernicla hrota*) was observed on the morning of April 10, 1938, on Delavan Prairie near Delavan, Wisconsin. The writer was watching flocks of Canada Geese returning from feeding on farm lands about 9.00 o'clock when one flock in flight showed a very small individual, apparently near the size of a large duck. The flock alighted in a grassy field near a pond and the small bird was observed with a nine-power binocular at about 250 yards in strong sunlight for about forty-five minutes and determined to be an American Brant. The brant while feeding was almost constantly beside the geese on land where an easy comparison of size and shape could be made. The shorter neck and the size of the bird, a little more than half that of the geese, were good marks. The black head, neck and upper breast with a sharp line of division between breast and belly were plainly visible. The broken white ring around the neck was seen as well as the grayish back and lighter-gray sides. The lower belly and under tail-coverts were white.

One specimen is reported as taken by Hoy at Racine on a former year and is preserved in the Hoy collection according to Kumlien and Hollister. Perhaps there are other more recent records that have been overlooked.—S. PAUL JONES, 509 West Avenue, North, Waukesha, Wisconsin.

A new breeding bird for New York State.—For the last three years I have suspected the Yellow-crowned Night Heron (*Nyctanassa violacea violacea*) of nesting in Nassau County, New York, but due to a preconceived notion that the birds were nesting in one of the large Black-crowned Night Heron colonies I failed to locate the nests. In 1936, I even saw adult Yellow-crowned Night Herons carrying sticks but they always seemed to disappear into the dense thickets of red cedar and smilax in

which a large Black-crowned Night Heron colony was situated and careful search amongst the hundreds of nests of the latter species revealed nothing.

On April 14, 1938, while exploring a red maple-tupelo swamp I came upon two pairs of Yellow-crowned Night Herons repairing old nests. The birds were definitely paired on this date and were engaged in some simple courtship displays. By May 10, four pairs were in this area each incubating five eggs. At the date of writing (May 30) there are healthy young in each nest. As far as I am able to ascertain this is the first definite breeding record of the Yellow-crowned Night Heron for New York State.—ALLAN D. CRUICKSHANK, *National Association of Audubon Societies, 1775 Broadway, New York City.*

Recent occurrence of the Flamingo in Puerto Rico.—Due to the fact that the Flamingo (*Phoenicopterus ruber*) has not been reported in Puerto Rico since the time of Gundlach's visits some sixty-five years ago, it seems of interest to record that in December, 1935, a local hunter observed two and shot one at El Faro de Cabo Rojo (the southwestern tip of Puerto Rico). He ate the bird, but preserved parts of its plumage which he has presented to me, more than sufficient to identify the species. Another hunter in whose reliability I have considerable confidence reports seeing a Flamingo at the same locality in 1937.—STUART T. DANFORTH, *College of Agriculture and Mechanic Arts, Mayaguez, Puerto Rico.*

Blue Goose in St. Joachim, Quebec.—On April 26, 1938, we had the pleasure of capturing a Blue Goose (*Chen caerulescens*) travelling with the flock of Greater Snow Geese (*Chen hyperborea atlantica*). The population of this flock amounts to some fifteen thousand birds. On their migration, the Greater Snow Geese stop at St. Joachim near Quebec City, from the end of March till the 15th of May of each year. According to Mr. Charles Frémont, Superintendent of Game and Fisheries for Quebec, about thirty Blue Geese accompany the flock of migrating Greater Snow Geese. The Blue Geese stick together and are easily identified and consequently none of them is shot at in autumn during the hunting season.—J. A. BRASSARD, *Jardin Zoologique, Charlesbourg, Quebec.*

Blue Goose in New Hampshire.—On May 2, 1938, a flock of Blue Geese (*Chen caerulescens*) was observed on the Green Acres Farm of Fred A. Lovering in Manchester, New Hampshire. The birds remained until May 14. During their thirteen-day stay these rare stragglers attracted the attention of many people. The writer was informed of the presence of the geese on May 9 by Dr. George S. Foster of Manchester. On three successive days, May 9, 10, and 11, we visited the Lovering Farm with members of the college ornithological society. The flock consisted of nineteen birds. The coloration of the head and neck of the birds was variable. One had the head and upper neck white; eight others had most of the head white with dark feathering which in some cases extended from near the top or base of the head along the hind neck; the color of the remaining members of the flock was less definite. A few had heads and necks that showed little white feathering.

The geese spent most of the day grazing in a field cut by a narrow drainage ditch. Occasionally, they frequented a nearby ploughed field. Mr. Lovering informed us that daily in late afternoon the entire flock winged its way in the direction of Lake Massabesic, two miles eastward, where the birds apparently spent the night. They exhibited a remarkable lack of shyness. One could always approach them rather closely. On all occasions they seemed to prefer to walk rather than to fly away from the observers. When they were forced into the air for flight motion-pictures, their reluctance to leave the pasture was pronounced. After a short flight sometimes in

V-formation, during which the entire flock quopped, the geese immediately returned to their feeding grounds.

Forbush reports one possible record of the Blue Goose in New Hampshire. It is that of a bird listed by Brewster as taken at Lake Umbagog, Maine, but claimed by O. W. Knight to have been shot in New Hampshire.—EUGENE J. GOELLNER, *St. Anselm's College Ornithological Society, Manchester, New Hampshire.*

Blue Goose and American Egret in Chester County, Pennsylvania.—This morning, April 28, 1938, I had the pleasure of seeing an adult, white-headed Blue Goose (*Chen caerulescens*) in a pond on Pickering Creek. This creek is on the estate of Mr. Frank B. Foster, known as 'Broadwater Farms,' about two miles south of Phoenixville, in northern Chester County. Mr. Foster has a number of tame Canada Geese breeding around the various ponds and dams he has made. There were also about a dozen wild Canada Geese in the pond this morning. The Blue Goose arrived about ten days ago and seems perfectly at home. Together with Mr. Foster, I observed this goose for some time through a binocular at about fifty yards. On a mud flat in another pond on Mr. Foster's place, I saw an American Egret (*Casmerodius albus egretta*), whose long plumes were very conspicuous. Egrets visit these ponds every summer and fall, but it is unusual to see one at this time of year.—WHARTON HUBER, *Academy of Natural Sciences, Philadelphia, Pennsylvania.*

Gray-breasted Tree Duck in Puerto Rico.—On October 16, 1937, a hunter brought me a specimen of the Gray-breasted Tree Duck (*Dendrocygna autumnalis discolor*) which he had shot that day at a pond in Añasco. The specimen, which is now in my collection, proved to be a female, and weighed 510 grams. Due to lack of comparative material here, it was sent to Dr. A. Wetmore for subspecific determination. He replies that it is unquestionably *discolor*. This makes a new record for the island, but throws some doubt on the subspecific identity of previous records which were unsubstantiated by specimens, but which have been considered as *D. a. autumnalis* on the basis of probability.—STUART T. DANFORTH, *College of Agriculture and Mechanic Arts, Mayagüez, Puerto Rico.*

Old-squaws taken in gill-nets.—Arthur A. Oehmeke, of the Biology Division, Wisconsin Conservation Department, reports that the majority of Old-squaws (*Clangula hyemalis*) that frequented the waters surrounding the Wisconsin Door County peninsula this last spring (1938) moved north by June 8, leaving only a few stragglers. He also reports that on February 12, sixteen of these birds were taken from a gill-net set in one hundred twenty feet of water in Lake Michigan about ten miles southeast of the Sturgeon Bay canal; on April 15, twelve were found in nets set in one hundred fifteen feet of water in Northern Green Bay eighteen miles northwest of Gills Rock; and on May 11, eighty were taken from a single net set in ninety feet of water fifteen miles northwest of Ellison Bay. One loon (sp.?) was also found in this latter net which was 11,000 feet long and was of four and a half inch mesh. The other nets set in one hundred twenty and one hundred fifteen feet of water were 16,800 and 14,000 feet long, respectively. Although it seems likely that the depth of the nets would make a great difference in the number of birds captured, it is probable that the difference in season also played an important part in this regard. Many more birds were reported taken by the fishermen of this locality, but accurate records are not available.—WALTER E. SCOTT, *Wisconsin Conservation Department, Madison, Wisconsin.*

Food habits of small falcons in north-central States.—During late years, a considerable amount of food material of the smaller falcons has come to hand

from Minnesota, South Dakota, and Iowa. This is represented for the most part by stomachs of birds sent in by cooperators, a few pellets of unquestionable origin, and observations made from time to time in the field. Identifications of foods were largely made by the authors, with some help from the U. S. Biological Survey.

The Pigeon Hawk (*Falco columbarius*) breeds sparingly in northern Minnesota, and, in the spring of 1937, the senior author located a nest near Lake Saganaga. The feeding of the family of five half-grown young by the adults was watched from a photographic blind. Food was brought to the nest ten times during the day observations were made and, although none of it could be positively identified, all appeared to be avian prey ranging from the size of a small sparrow to perhaps that of a Flicker (*Colaptes auratus*). The male, which captured almost all of the prey, plucked it before bringing it to the female, and she, in turn, fed the young. The female stayed near the nest and was repeatedly seen to swoop down from the jack-pine tops and take dragonflies (Odonata) on the wing and was once seen to make an unsuccessful attempt to capture a Flicker. Four pellets taken from the nest were almost wholly of much disintegrated feathers, some of which were undoubtedly those of Fringillidae and Turdidae. Pigeon Hawks are only infrequently encountered as migrants in the States with which this writing deals. One May stomach contained a small flycatcher (probably *Empidonax* sp.). Three September stomachs also contained avian remains: one, an English Sparrow (*Passer domesticus*); another, a fringillid; and the third, two Tree Swallows (*Iridoprocne bicolor*).

The Sparrow Hawk (*Falco sparverius*), on the other hand, is not only a common breeding bird throughout much of the region, but in Iowa it also is found in some numbers as a winter resident. We have no stomachs taken earlier in the year than April, but random field observations in central and southern Iowa suggest that mice of the genera *Microtus* and *Peromyscus* constitute staple foods of the wintering birds. Of eight April stomachs, all contained mice, chiefly *Microtus* spp., and one also contained parts of a striped ground squirrel (*Citellus tridecemlineatus*) and two frogs. There was a trace of undetermined bird feathers in one of the stomachs, and the contents of all included varying quantities of invertebrate débris, principally of grasshoppers (*Melanoplus* spp.) and crickets (*Gryllus* sp.), in addition to Coleoptera, Lepidoptera, and spiders. Five pellets gathered in early May from the vicinity of an Iowa nest consisted of mouse fur and bone fragments, but only one of five stomachs for this period contained mouse (*Microtus* sp.). The bulk of the stomach material was of insects, predominantly adult Coleoptera and larvae of Lepidoptera; other items were dragonflies and spiders.

For June, July, and August, our specimen data are limited, but a vast number of general observations in central and northwestern Iowa indicate that the grasshoppers so abundant in these months form practically the entire diet of the Sparrow Hawks. The contents of three out of four stomachs confirm this concept, but the fourth also contained a meadow mouse. Errington (Condor, 35: 19-29, 1933) observed that mammals and birds were represented in the diet of a nesting pair of southern Wisconsin Sparrow Hawks and their young mainly in May and June; insects provided nearly all of the food taken in July. Eight September stomachs contained little except grasshoppers and crickets which were eaten in approximately equal proportions. There was no evidence of vertebrate prey in this lot of stomachs, and the recognized food seen in possession of Sparrow Hawks along highways was consistently of Orthoptera, as expected.

We have insufficient data from which to judge just when the shift in Sparrow Hawk diet from invertebrate to vertebrate prey occurs in the autumn, although analogous

data from other insect-eating hawks lead us to believe that it may take place in early October, as the availability of Orthoptera and similarly large and edible insects diminishes.—W. J. BRECKENRIDGE, *Museum of Natural History, University of Minnesota, Minneapolis, Minnesota*, and PAUL L. ERRINGTON, *Iowa State College, Ames, Iowa*.

Whooping Crane in Louisiana.—Just at noon, June 5, 1937, four Whooping Cranes (*Grus americana*), flying at about four hundred to five hundred feet elevation, all adults and giving voice often, passed from east headed west over Avery Island. These birds were probably on their way to join the seven birds resident, and now reported nesting, two and one-half miles west and north of White Lake in Vermilion Parish.—E. A. McILHENNY, *Avery Island, Louisiana*.

Sandhill Crane in Kentucky.—On April 3, 1938, I found a Sandhill Crane (*Grus canadensis tabida*) in a pasture in the southern part of Jefferson County on the outskirts of Louisville. The pasture was perhaps three-quarters of a mile wide, open with only one or two scattered trees on it, and gave the bird the opportunity to see anyone approaching from any direction. It was very wary and would take flight when anyone approached within one hundred fifty or two hundred yards. It would fly in a wide circle, calling as it flew, but would always return to the field. The ground was dry, except for two small wet-weather ponds at one end and the bird was continually feeding among the fodder scattered around for the cattle. Upon questioning the farmer who owned the land, I learned that the crane had first appeared or been noted on March 31. I personally observed it on April 3, 4, 5 and 6, when it was last seen.

The single record I have had of this bird at Louisville prior to this one was obtained on March 19, 1933, when a flock of thirteen was seen in flight.—BURT L. MONROE, *207 N. Birchwood Ave., Louisville, Kentucky*.

Yellow Rail at Churchill, Manitoba.—While collecting birds on the western bank of the Churchill River in northern Manitoba, on July 28, 1937, I flushed and shot a Yellow Rail (*Coturnicops noveboracensis*) which rose from the grass a few feet ahead of me. Thinking there might be more in the 'immediate' vicinity, I began a systematic search. Within an hour I flushed four more, three of which I secured. All four collected proved to be adult males with the testes greatly enlarged. The strange clicking notes of these birds were heard on various occasions but when approached they would stop calling and keep out of sight.

All records of birds seen or heard were made along the west bank of the Churchill River from the old Hudson's Bay Post southward for about a mile or more, approximately four to five miles southwest of Churchill townsite. From what I observed, their habitat is the grass and sedge marsh-community occurring above the high-water mark and intersected at short intervals by small streamlets. Most of the green carpet appeared to be about a foot deep, but along the borders of the streamlets it grew more lush. Here there appeared to be runways and signs of the rails' activities, and it was from these places that the birds were usually flushed. In 'Birds of Churchill' by Taverner and Sutton (*Annals Carnegie Mus.*, 23: 33, 1934) the bird is considered hypothetical, based on Mr. Arthur Twomey's experience in June 1932, when he heard the bird but was unable to get a glimpse of it. In 1902, Edward A. Preble collected several at York Factory and the bird is probably more common at Churchill than previously supposed. The secretive habits of the Yellow Rail and the great difficulty of flushing them, as well as the restricted habitat, are probably responsible for the absence of other records. The Indians informed me that the clicking notes

were made by an insect rubbing its feet across its back! Apparently the elusiveness of the bird has entirely deceived them also.

The specimens are now in the collection of the Cleveland Museum of Natural History.—ARTHUR B. FULLER, *Cleveland Museum of Natural History, Cleveland, Ohio.*

American Woodcock in Thunder Bay district, Ontario.—The first indication that the American Woodcock (*Philohela minor*) might be breeding in this locality was in June 1937, when one was heard by T. M. Shortt of the Royal Ontario Museum of Zoology, who was here on a collecting trip at that time. The spot was about ten miles west of Port Arthur. On May 8, 1938, therefore, I visited the same place, and heard and observed a male on this and subsequent occasions. Suitable territory in the neighbourhood was later visited and two more 'fighting' males were discovered, and on May 28, information was received that a nest had been found by a man clearing land, some distance from where the other birds had been observed. This nest was visited on May 29, when the bird was incubating four eggs. These, on examination, proved to be infertile, probably due to the cold, snowy weather of the early part of the month.

This is the first time that this species has been definitely known to occur in this district.—L. S. DEAR, *Port Arthur, Ontario.*

Baird's Sandpiper in Texas.—Apparently Baird's Sandpiper (*Pisobia bairdi*) is a rare migrant in Texas. Streker (Bull. Baylor Univ., 15: 20, 1912) lists only three Texas localities whence this species has been recorded: Boerne, Kendall County; San Angelo, Tom Green County; Alpine, Brewster County. Griscom and Crosby (Auk, 42: 528, 1925) record two specimens from near Brownsville. All these localities are west of the meridian passing through San Antonio. Williams (Auk, 55: 62, 1938) did not record it in the vicinity of Houston during his five years of observation. For this reason it seems advisable to report the taking of three birds twelve miles southwest of Eagle Lake, Colorado County, Texas, on April 15, 1938. Two others were observed on the same day in open short-grass prairie about six miles northeast of Eagle Lake. These two localities seemingly are near the eastern edge of the migration route followed by this species in passing northward through Texas. The westernmost record is from Alpine in trans-Pecos Texas.—WILLIAM B. DAVIS, *Texas Cooperative Wildlife Service, College Station, Texas.*

Scandinavian Lesser Black-backed Gull at Key West, Florida.—On the morning of March 10, 1938, Messrs. James J. Murray, of Lexington, Virginia, Edward M. Moore, of Key West, and the writer were on the head of one of the piers in the Key West Yacht Basin awaiting a Coast Guard plane for an aerial survey of the Lower Keys. Many gulls were flying about and Mr. Moore suddenly pointed out one which he described as "very dark." Catching sight of it at once, we saw that it was clearly a black-backed gull, indeed, the veriest tyro could not have mistaken it. Other than the striking coloration, the size of the bird was arresting. It was constantly in company with Herring Gulls, and was studied for an hour or more. Every opportunity was given for comparison both in the air, and at rest on a nearby breakwater. Messrs. Moore and Murray were sure that it was just the size of the Herring Gulls, the writer thought it a shade larger. Range of observation varied from about fifty to two hundred yards. The bird exhibited the following characters: under parts pure white; bill distinctly yellow as were the feet; small white spots appeared at tips of primaries and there was a white edging on the front of the wings as well as on the hinder rim; under side of wings rather dusky, this area extending toward the body on

forward portion; wings entirely black above, but the saddle, or back, was of a lighter shade, with a distinct brownish cast. That the bird was a Lesser Black-backed Gull was as obvious as anything could well be. Happily, Dr. Murray was familiar with the bird, having seen hundreds of them on a European trip recently. He concluded at the time that it was the British Black-back (*Larus fuscus fuscus*) but we subsequently found that it was possible to confuse this bird with the Yellow-footed Gull, that form of the Western Gull known as *Larus occidentalis livens*.

Dr. Murray, having to be in New York shortly afterward, went to the American Museum of Natural History and spent some while there going over skins of these gulls, and has reached the following conclusion. *L. o. livens* and *L. f. graellsii* are so similar that identification in the field is hardly possible. However, this does not apply to the Scandinavian form, *L. f. fuscus*, which is darker than either *graellsii* or *livens*, and in addition, has brown on the back which neither of the others has. The Key West bird certainly had brown in the back, and he says that "we are entirely justified in reporting it as *Larus fuscus fuscus*." This is the first record for Florida or any part of the South, and the second for North America, one having been seen September 9, 1934, in New Jersey by Charles A. Urner and James L. Edwards (Auk, 52: 85, 1935). Though aware of the fact that the above is a sight record, it appears so conclusive that no hesitation is felt in giving the record.—ALEXANDER SPRUNT, JR., *R. F. D. No. 1, Charleston, South Carolina.*

Herring Gulls following the plow.—During the last two years around the New York City region I have been extremely interested in the apparently newly acquired habit of the Herring Gull (*Larus argentatus smithsonianus*) of following the farmer's plow in search for food. In other sections of the United States I have seen the Ring-billed Gulls and, of course, the Franklin's Gulls acting in this manner. On the other hand, I have known the Herring Gull quite intimately for a score of years on both breeding and wintering grounds, but not until the last two years have I seen them fluttering, gliding and diving behind the plow. Until recent years the ever increasing number of wintering gulls around New York City depended on the extensive city rubbish-disposal centers for a great deal of food. Today we find these waste dumps disappearing and the efficient incinerators taking care of all refuse disposal. Perchance this change in one of our major concentration areas of wintering Herring Gulls is causing them to seek new sources of food; and perchance within a few years these birds will be frequent companions of the farmer.—ALLAN D. CRUCKSHANK, *National Association of Audubon Societies, 1775 Broadway, New York City.*

Food of young Laughing Gulls.—At Stone Harbor, New Jersey, on July 11, 1937, I was banding young Laughing Gulls (*Larus atricilla*). During the process several of the birds disgorged their food. One disgorged twenty-three Japanese beetles, which would indicate that this bird is another potential enemy of the beetle.—HERBERT BUCKALOW, *611 East 2d St., Milford, Delaware.*

Nelson's Downy Woodpecker from Colorado.—In working over the Downy Woodpeckers in the collection of The Colorado Museum of Natural History, we have found that three races are represented in the State. The resident Batchelder's Woodpecker (*Dryobates pubescens leucurus*) is the common form; the Northern Downy Woodpecker (*Dryobates pubescens medianus*) has been recorded from the eastern part of the State (Lincoln, Proc. Colorado Mus. Nat. Hist., 1913) and is represented in our collection by five specimens. This past season two examples of Nelson's Downy Woodpecker (*Dryobates pubescens nelsoni*) were taken and it may be that the majority of small woodpeckers wintering in the northern portion of the State, which have

been assumed to be *leucurus*, will prove to be *nelsoni*. The first two of the latter, a typical female and male, were taken by Robert L. Landberg, of the Museum staff, at Rockport, Weld County, Colorado, on January 23, 1938 (C.M.N.H. nos. 18337-8). These specimens are of large size and have prominent white wing-markings and almost immaculate, unbarred tails. In addition, there are two other specimens in the collection (C.M.N.H. nos. 13739 and 18563) taken at Swink, Otero County, October 30, 1908, and at Barr Lake, Adams County, Colorado, on February 26, 1938, respectively, that are as large as *nelsoni* with wing-markings the same, but with tails more heavily barred, which are intermediate between *nelsoni* and *leucurus*. The above specimens were submitted to George Willett, of the Los Angeles Museum, and we are indebted to him for his determinations.—ALFRED M. BAILEY AND ROBERT J. NIEDRACH, *The Colorado Museum of Natural History, Denver, Colorado*.

Data from ninety Eastern Crows.—At 4 a. m. on March 9, 1938, a crow roost near Sharon, Rock County, Wisconsin, was dynamited, killing well over 5,000 Eastern Crows (*Corvus brachyrhynchos brachyrhynchos*). On the next day two men assisted the writer in a search for bands but none was found on the entire lot. It was noticed, however, that a number of birds had lost part of their toes or legs. Ninety birds were picked up at random and given to Dr. T. T. Chaddock, Veterinarian of the Wisconsin Conservation Department, for posting. As a result of his examination it was found that the gizzards in all but one specimen were entirely empty of food and that the males and females were almost equal in numbers. Of seventy-seven specimens, an estimate of age showed twenty-three to be old birds and fifty-four young. Old birds ranged in weight from 419 to 567 grams and averaged 492.33 grams; while young birds ranged from 335.5 to 588.41 grams and averaged 498.14 grams. Of the twenty-three old birds, fourteen were females and eight were males. Females (44) averaged heavier than males at 496.48 grams and ranged between 401.7 and 588.4 grams. Males (45) averaged 486.65 grams and ranged between 329.8 and 576.4 grams. The heaviest bird (a female) weighed 588.4 grams or 1 pound 4.75 ounces, while the lightest bird (a male) weighed 329.8 grams or 11.63 ounces. Fatty degeneration of the liver was noted in sixty-nine of the ninety specimens and other diseases were observed. Measurements of the testes and ovaries were secured and furnished to C. T. Black, of the Illinois Natural History Survey, to assist in a co-operative crow investigation now in progress. The need for more banding of crows was clearly evident and should be encouraged. Although the dynamiting of this roost is of small account compared to activities in some more southerly States, the writer sincerely hopes that this first experience will also be the last for Wisconsin.—WALTER E. SCOTT, *Wisconsin Conservation Department, Madison, Wisconsin*.

Chickadee neurasthenia.—I have had a number of experiences with Chickadees (*Penthestes atricapillus atricapillus*) which suggest a type of nervous debility, perhaps due to a corresponding excitement. Two of these experiences I would like to record.

Five Chickadees were feeding at our second-story shelf, carrying sunflower seeds to trees about twenty feet away and there opening them and eating the meats. Suddenly, one bird swung under the twig on which it had been cracking a seed, and hung upside down by both feet. All the rest, except one, flew away, so I suspect something frightened them at the moment this happened. The remaining active Chickadee twice approached the unconscious (?) one, uttering sharp, high notes. It exhibited concern, but in a few moments flew off. The stricken Chickadee hung motionless swaying slightly with the wind like a dead leaf. This lasted for about four minutes and then the bird came to, as suddenly as the spell had descended upon it. Im-

mediately, it began calling the familiar *chick-a-dee-dee-dee* very excitedly and soon flew away.

The second experience occurred when a Tree Sparrow (*Spizella arborea arborea*) was feeding on the shelf. A Chickadee landed on the edge of the shelf, six inches from the Tree Sparrow; immediately the latter showed the usual antipathy to another bird on the feeding tray by a defiant attitude with open wings and bill. The Chickadee started to go, when apparently it was caught by extreme nervous excitement. The legs trembled, the body was jerked from side to side and the head was thrust backward and forward while the bird seemed rooted to the spot. This condition lasted about ten seconds; then, the bird regained poise and fairly tumbled off the shelf in its haste to get away. It appeared normal a few moments later. With the start of the performance, the Tree Sparrow resumed feeding and paid no further attention. I shall be interested if other observers have had similar experiences.—

GORDON BOIT WELLMAN, Wellesley, Mass.

A Robin's nest containing eight eggs.—On April 26, 1938, at my brother's home in Media, Pennsylvania, I found eight eggs in a Robin's nest. Neither my brother nor his wife had noticed any unusual behavior among Robins (*Turdus migratorius*) about the lawn. I suspected, however, that two females had laid these eggs, inasmuch as in the only other recorded case of eight eggs in a Robin's nest, two females had incubated them side by side (Forbush, E. H., 'Birds of Massachusetts and other New England States,' 3: 413, 1929). I therefore examined the eggs very carefully. First I found it possible to separate them into two groups of four each by a general inspection of their contours. One 'set' had sharper ends than the other. My sister-in-law then noticed that the set with sharp ends was uniformly a few shades lighter in color than the set with blunt ends. On measuring the two sets, I found further evidence for their double origin:

Light set, sharp ends	Dark set, blunt ends
30 x 21 mm.	29.5 x 22 mm.
30.5 x 22	29.5 x 22
31 x 21.5	29 x 22
31 x 21.5	29 x 23

I watched this nest carefully on subsequent visits to Media: *May 3*, eight eggs still present; *May 7*, one egg just hatched; *May 8*, one young Robin, one pipped egg, six un-pipped eggs; *May 10*, two young Robins thriving, six un-pipped eggs; *May 11*, no change; *May 16*, oldest fledgling almost ready to fly. It has pushed out the other fledgling, which is dead on the ground; three eggs have also been pushed out. Only one of these eggs is to be found; it contains an embryo about ready to hatch and not noticeably decomposed. *May 19*, fledgling has flown; three remaining eggs sterile.

My conclusions from these facts are that an unmated female laid her eggs, none of which hatched, at about the same time that the mated female did, but that this unusual happening resulted in irregular oviposition and incubation on the part of the mated female, so that her eggs hatched, actually or potentially, at irregular intervals. That the superfluous female was unmated is suggested further by the fact that at no time did a third Robin object to my presence at the nest.—C. BROOKE WORTH, Dept. of Zoölogy, Swarthmore College, Swarthmore, Pennsylvania.

Starlings summer in Arkansas.—Three Starlings (*Sturnus vulgaris*) were observed sitting on the crosspiece of a light-wire post, along the road, six miles west of Fayetteville, on June 15 and 16, 1938. Identification was made at close range with

an eight-power Zeiss binocular.—T. L. QUAY, *University of Arkansas, Fayetteville, Arkansas.*

Red Crossbill breeding in the Great Smoky Mountains National Park.—On April 10, 1938, I observed an adult female Red Crossbill (*Loxia curvirostra* subsp.) feeding a juvenile in a grove of short-leaved pines near my home, close to the Little Pigeon River, in Gatlinburg, Tennessee. The familiar notes of this species had attracted me to the scene where I caught sight of an adult male and female bird along with two heavily-streaked birds which I did not at once recognize. However, they were in view but a very short time before one of the strange-looking individuals suddenly began quivering its wings, whereupon the olive-green female placed food in its mouth. I now realized that these two unfamiliar birds were young Red Crossbills and the fact regarding the uncrossed mandibles of the juvenals, mentioned by Mr. Ludlow Griscom in his 'A monographic study of the Red Crossbill' (Proc. Boston Soc. Nat. Hist., 41: no. 5, 1937), then occurred to me.

The young birds were capable of fair flight but one in particular I kept in view for some time. Edging closer and closer to the adult female who was feeding upon seeds of the pine, the juvenal would cause the older bird to desert her perch three or four successive times before she yielded and repeated the feeding episode. Altogether I witnessed this on three occasions before all the birds were lost to view. During this time the adult male and the second young bird were nearby, for I occasionally heard the notes of the adult. The notes made by the young birds were not as "ringing" in quality as those of the adults, and while begging for, or insisting upon, food, the juvenals uttered cries much like those made by very young domestic chickens.

Again on the following day I witnessed an adult female Red Crossbill feeding a young bird. This took place less than a mile from the locality where the previous observation had been made. I was directed to the spot by Mr. Joseph Manley, Assistant Forester, Great Smoky Mountains National Park, who had informed me of some strange-looking birds, somewhat resembling female and immature Purple Finches, which had recently been feeding on the ground near his home. The feeding episode was observed twice by Mr. Manley and me before the crossbills disappeared. On this occasion we noted to good advantage the very short tail of the young bird. Since the nearby mountains were carpeted with a recent heavy snowfall, Mr. Manley suggested that this may have been a factor in forcing these birds down from the spruce-fir zone. (The species frequently visits areas far below the Canadian zone at other times of the year, however.)

Several days later, on April 19, I again observed a young Red Crossbill. This time the place was some miles distant in the very heart of the Great Smokies—at Indian Gap (elevation 5200 feet), near the Tennessee-North Carolina state line. The bird was accompanied by an adult crossbill and was seen at close range—its sides heavily streaked, the tail very short, the mandibles not crossed, and the notes which it uttered decidedly unlike those in the repertory of the Purple Finch—a species with which it might be confused. This bird and the other juvenals which I have seen, were darker than the young bird pictured by Audubon.

Mr. Griscom, who is authority for the statement that there is no authentic breeding record south of Pennsylvania, and who presumes that a resident breeding population may well inhabit this area, has urged me to publish these observations.—ARTHUR STUPKA, *Park Naturalist, Great Smoky Mountains National Park, Gatlinburg, Tennessee.*

Polygamy in the Western Lark Sparrow.—In 1936, I found and photographed a nest of the Western Lark Sparrow (*Chondestes grammacus strigatus*), at Regina,

Saskatchewan, the eggs of which successfully hatched. On May 24, 1937, I again located a nest and on May 28, 1937, a second nest at least one hundred yards distant from it. On the latter date I saw the male and female copulating about twenty feet from nest no. 1, and was surprised to see a second female with wings quivering, fly close to the pair. The male then commenced to copulate alternately with the two females. This was accomplished several times and one of the females then flew to nest no. 1, while the other, when disturbed, flew immediately to nest no. 2, the site of which was clearly visible from where I was standing. This I think is evidence that one male had two mates. Both nests were on the ground and in each case on the northwest side of a clump of grass.—E. H. M. KNOWLES, 1104 College Ave., Regina, Saskatchewan.

Rose-breasted Grosbeak in Colorado.—The Rose-breasted Grosbeak (*Hedydipna ludovicianus*) is an unusual species in Colorado, having been recorded only a few times; the first record was by W. W. Cooke ('Birds of Colorado,' p. 167, 1897) of a pair that nested near Longmont, Boulder County, in the summer of 1894. Another pair was observed near Loveland, Larimer County, June 1, 1902, by L. E. Burnett, and the male was collected (W. L. Burnett, Condor, 4: 94, 1902). This specimen, the first taken in the State, is in the collection of this museum (C. M. N. H. no. 715).

During the summer of 1924, Robert B. Rockwell saw a bird on a feeding-shelf of Dr. C. E. Sidwell, at Longmont, Boulder County, and Dr. Sidwell has recently written Mr. Rockwell regarding his birds as follows: "I first saw the Rose-breasted Grosbeak on my feeding-shelf, May 10, 1924. The next year he returned on the same day, May 10. I wrote in my notebook, 'he is plump and sleek. Every day he comes several times to eat the sunflower seeds and later in the season he brought his mate and a young one belonging to him, because I saw him feed it.' May 5, 1926, he returned, and I quote from my notes, 'Well, old Rose-breast arrived five days ahead of time, and he seems fond of sunflower seeds'. May 13, 1927, he came again and it proved to be the last season for we missed him the middle of the summer. Each year we had observed the bird all during summer, but he left fairly early in the fall. Every year we saw the Black-headed Grosbeaks on our feeding-shelf, sometimes observing both species at the same time, but the Rose-breast has not been seen since 1927."

Two other sight records are available. Bergtold mentions one bird at Colorado Springs, El Paso County, observed by Mrs. Ivah Elliott, May 11, 1929 (Bird-Lore, 31: 279, 1929), and another (Bird-Lore, 37: 295, 1935), by E. Hellstern, of Fort Morgan, Morgan County, during May or June 1935.

In view of the rarity of the Rose-breasted Grosbeak in Colorado, we were greatly pleased to see a male on May 20, 1938, feeding among the scrub oaks in the broken country twenty miles southeast of Denver, in Douglas County; it was an added pleasure to have the privilege of showing the bird to our companion, the veteran Colorado naturalist, Horace G. Smith, who has accomplished so much in advancing knowledge of our local birds. The specimen was collected (C.M.N.H. no. 18900) and proved to be in worn plumage with testes undeveloped.—ALFRED M. BAILEY AND ROBERT J. NIEDRACH, *The Colorado Museum of Natural History, Denver, Colorado.*

Notes from West Virginia.—For the past three years I have been attempting to build up a private collection of West Virginia birds and through this work, I have been able to visit many interesting localities within the State. The principal parts of the State where collecting has been carried on are: Brooke County; Ohio County; near Point Pleasant, Mason County; Fort Gay, Wayne County; Pineville, Wyoming

County; Alderson, Greenbrier County; Cranberry Glades, Black Mountain, Thorny Flat (elevation 4400 feet), and Marlinton, Pocahontas County; Canaan Valley, Tucker County; Preston County; Leetown, Jefferson County; Mount Storm, Grant County. All the specimens collected in this State, with but one or two exceptions, are in my private collection at my home near Short Creek, West Virginia.

WILSON'S SNIPE, *Capella delicata*.—I secured a juvenile male of this species in Canaan Valley, Tucker County, about three miles south of Davis, on July 13, 1937. The elevation is about 3300 feet. The farmer, on whose land I was collecting, told me that he had a number of times during the summer, flushed from the same wet meadow where I took the juvenile snipe, two or three birds that made a "funny rasping noise" when they flew. He called them "snipes."

There is no definite breeding record for this bird in West Virginia but the collection of the juvenile male and the statement of the farmer are good indications that the birds nested there during 1937. There are one or two summer sight records for the State. This collected specimen extends the summer range of the bird definitely southward.

WESTERN SANDPIPER, *Ereunetes maurii*.—Two non-breeding females were taken near Leetown, Jefferson County, at a small pond of the federal fish hatchery, on July 15, 1937. Both birds were in summer plumage which showed very little wear. They were very easily approached. These specimens establish a previous sight record made by Poland at the same locality (Auk, 55: 129, 1938).

LONG-BILLED MARSH WREN, *Telmatodytes palustris palustris*.—Of five specimens taken in the fall of 1936, all proved to be of this subspecies. A male and a female were taken September 12, at Beech Bottom, Brooke County, and three females were taken at the head of Lake Terra Alta, Preston County, on September 17, 19, and October 14, respectively.

SHRIKE, *Lanius ludovicianus* (ssp.?).—A male was taken on the Knight Farm near Lakin, Mason County, March 30, 1937. On careful comparison of this specimen with the series in the Carnegie Museum, Pittsburgh, Pennsylvania, it is evident that it is not a typical individual of *L. l. migrans*. In coloration, especially of the upper parts and in the amount of gray on the chest, it agrees very closely with the southern race, *L. l. ludovicianus*, but approaches *L. l. migrans* in tail and wing measurements. The bill is intermediate. Breeding specimens are needed to establish definitely the form found in the southern part of the State. Measurements of the specimen are as follows: wing, 100.0 mm.; tail, 96.0; exposed culmen, 14.5; depth of culmen at base, 9.5; tarsus, 27.0; bill from nostril, 11.5.

WESTERN PALM WARBLER, *Dendroica palmarum palmarum*.—Seven specimens taken during the fall of 1937 are all typical of the western race. Specimens are as follows: one male, September 12; one female, September 21; and one male, October 17, all taken near my home on Bethany Pike, Ohio County; two females, September 17, and two females, September 18, were taken on Knight Farm, near Lakin, Mason County. Published records show only one specimen of this race collected previously from the Northern Panhandle, that taken by Sutton on September 14, 1935 (Auk, 53: 89, 1936).

GRINNELL'S WATER-THRUSH, *Seiurus noveboracensis notabilis*.—A male and a female were taken two miles southeast of Holliday's Cove, along Harmon Creek, Brooke County, September 11, 1936. Dr. George M. Sutton collected the male and the female was collected by myself. These are the only two specimens that, to my knowledge, have been taken in this State.

RED-WINGED BLACKBIRD, *Agelaius phoeniceus*.—Dr. Alexander Wetmore in his

recent paper ('Observations on the birds of West Virginia,' Proc. U. S. Nat. Mus., 84: 401-441, 1937) lists the collecting of a Giant Red-wing, *A. p. arctolegus*, near Enon, Nicholas County, May 11, 1936. This was the first record of this larger form for the State.

I secured eight Red-wings, two males and six females, from a flock of about three hundred on the Knight Farm, near Lakin, Mason County, on December 30, 1936. On comparing these specimens with skins in the Carnegie Museum, Pittsburgh, Pennsylvania, the two males and four females were determined as *A. p. arctolegus*. The other two females were assigned to the common eastern form, *A. p. phoeniceus*. Identifications were made by Miss Ruth Trimble of the Carnegie Museum staff and myself. These identifications were checked by Dr. H. C. Oberholser of the U. S. Biological Survey.—KARL W. HALLER, *Bethany College, Bethany, West Virginia*.

Some rarer birds at the Falls of the Ohio.—The Falls of the Ohio River at Louisville, Kentucky, made famous in Audubon's writings, continue to produce some of the rarer records for the State. Several made here in recent years are worth reporting.

SNOWY EGRET, *Egretta thula thula*.—Six birds were seen on August 21 and nine on August 22, 1937. Their yellow feet were easily noted as the birds flew and waded about.

WOOD IBIS, *Mycteria americana*.—One individual, first seen at a small pond in southern Indiana, a very short distance from the Falls, on August 5, 1934. It appeared on the Falls proper on August 12 and was recorded again on August 18.

PIPING PLOVER, *Charadrius melanotos*.—Two birds seen on September 5, 1937. One was collected and is now in my possession.

RUDDY TURNSTONE, *Arenaria interpres morinella*.—Seen on the Falls from September 1 through September 27. Two specimens in my collection, both females in winter plumage, were taken September 27, 1936, and September 7, 1937, respectively.

WESTERN WILLET, *Catoptrophorus semipalmatus inornatus*.—One record only: a single bird was seen on August 21, 1937, and I collected it on August 22. It was a female and in a somewhat emaciated condition. The left leg had been broken and had healed at about a thirty-degree angle, giving the bird a limping and sidewise motion when walking. It is a coincidence that on September 6, 1936, at Ashtabula, Ohio, Dr. Lawrence Hicks, of Columbus, collected a female Willet in exactly this same condition (Auk, 54: 536-537, 1937). This is the first specimen taken in Kentucky.

BUFF-BREASTED SANDPIPER, *Tryngites subruficollis*.—Three individuals of this species were observed walking among the rocks and sandhills on September 17, 1936. Two were collected and the skins are in my possession at the present time. This establishes the first published record, to my knowledge, for the State.

SANDERLING, *Croethia alba*.—These birds are seen here in flocks of as many as twenty or thirty individuals and appear each year with regularity. They have been recorded from early August to October 12. Two specimens in my collection, taken August 2, 1936, are yet in the brownish breeding plumage. A third specimen, taken September 11, 1937, has changed to the winter plumage.

CASPIAN TERN, *Hydroprogne caspia imperator*.—This tern is a very regular autumn migrant to the Falls of the Ohio, appearing as early as August 4 and recorded regularly from August 21 through September 20; most often seen in flocks of three, four or five but has been seen in flocks numbering as high as fifteen individuals.—BURT L. MONROE, *Curator, Kentucky Ornithological Society, Louisville, Kentucky*.

High mortality at the Washington Monument.—A total of 576 individuals, the largest number of birds to strike the Washington Monument, Washington, D. C., in a single night in recent years, was picked up at the base of the shaft on the night of September 12, 1937. All came down in the hour and a half from 10.30 p. m. to midnight. I identified twenty-four species, represented as follows: Long-billed Marsh Wren, three; White-eyed Vireo, eighteen; Yellow-throated Vireo, one; Red-eyed Vireo, 209; Philadelphia Vireo, two; Black and White Warbler, ten; Blue-winged Warbler, one; Tennessee Warbler, two; Parula Warbler (subsp.), twenty-three; Magnolia Warbler, thirty-four; Cape May Warbler, one; Black-throated Blue Warbler, one; Black-throated Green Warbler, twenty-two; Blackburnian Warbler, four; Chestnut-sided Warbler, eight; Bay-breasted Warbler, two; Black-poll Warbler, one; Palm Warbler (subsp.), one; Oven-bird, thirteen; Connecticut Warbler, two; Yellow-throat (Maryland and other subsp.), 189; Yellow-breasted Chat, one; American Redstart, twenty-seven; Scarlet Tanager, one.

September 12 was a clear day; the temperature dropped from a high of 75° at 3 p. m. to 63° at midnight; the wind was from the north and it increased in velocity from eight miles per hour at 8 p. m. to ten miles at 12 p. m.; the humidity was 65% at 8 p. m., 70% at midnight; the moon set about 10.30 p. m.; a slight mist enveloped the top of the shaft.

The average yearly mortality at the Monument since 1932 is 328 individuals; thus it can be seen that 576 in one night is quite out of the ordinary.—ROBERT OVERING, *Landover, Maryland*.

An orgy of ants.—On April 29, 1938, I found a group of birds feeding in a driveway near a house in Crum Creek Woods, Swarthmore, Pennsylvania. They ate as if there were an abundance of food spread before them. Robin, Blue Jay, Cardinal, and Brown Thrasher fed side by side without any sign of animosity. Wondering what common food would attract a vermicore, an omnivore, a graminivore, and an insectivore, I disturbed the birds long enough to find that their feast consisted of winged ants. A nest of these subterranean insects must have existed under the macadam driveway, for a procession of brand-new imagines was emerging from several small holes in the hard road-surface.

Retreating to a distance of about a hundred feet, I watched the birds return to their table. There were two Blue Jays, two Thrashers, three or four Robins, and apparently only one Cardinal, a male. The birds did not feed all at once, but came and went intermittently, each one staying three or four minutes at a time, returning at intervals of from ten to fifteen minutes. Sometimes there was no bird on hand for a five- or ten-minute period, at the end of which the road would be covered with several hundreds of ants. At these times a number of the ants would be successful in reaching the edge of the driveway, where they could climb up grass stems and fly away.

When the birds returned to such a large congregation of ants, they would eat at top speed. The Thrashers consumed seventy ants per minute; the Robins, fifty; Cardinal, forty; and Blue Jay only twenty-five.

A record of one hour's watching follows:

Species	Arrived	Left	Ants consumed
Robin, M	9.10	9.16	300
Cardinal, M	9.12	9.14	80
Robin, F	9.12	9.17	150
Thrasher	9.14	9.20	420
Robin, M	9.20	9.24	200
Cardinal, M	9.21	9.22	40
Robin, F	9.25	9.30	250
Robin, F	9.45	9.51	300
Robin, M	9.45	9.49	200
Blue Jay	9.45	9.49	100
Cardinal, M	9.45	9.49	160
Thrasher	9.47	9.52	350
Thrasher	9.51	9.52	70
Robin, M	9.55	9.56	50
Thrasher	9.56	9.56.5	35
Cardinal, M	9.57	9.59	80
Thrasher	10.02	10.05	210
Robin, M	10.07	10.08	50
		Total	3155

After this the ants appeared in smaller numbers; and I have no way of knowing how long they were emerging before I discovered them. But is it any wonder that insects must be prolific, when, during one hour, these three thousand souls were of necessity sacrificed on the altar of avian voracity in order that fifty or a hundred might fly away during the confusion?

Had there been any flycatchers about, this scene would have been reminiscent of the tropical association of varied bird species with army ants and their winged prey. But there were no flycatchers; a Wood Thrush, singing in a nearby bush, failed to join in the slaughter; and, strangest of all, the Flicker, or 'Ant-eating Woodpecker,' drummed, oblivious, on a tall tulip poplar in full view of the carnage.—C. BROOKE WORTH, *Swarthmore College, Swarthmore, Pennsylvania.*

RECENT LITERATURE

Jackson and Sclater's 'Birds of Kenya Colony and the Uganda Protectorate.'¹—Notwithstanding the fact that East Africa has long been a favorite resort for hunters and ornithologists, a comprehensive account of its bird life has been lacking until the appearance of the splendid work of Jackson and Sclater which is now before us. It is peculiarly fitting that this work should have been conceived and carried well on to completion by Sir Frederick Jackson since he did so much to elucidate the natural history of the region and spent many years there as explorer, organizer, Lieutenant-Governor (of Kenya) and Governor (of Uganda). While he did not live to see the completion of his work, Lady Jackson has seen to it that it was finished and published and in this accomplishment she has been fortunate in securing the services of Dr. W. L. Sclater, the well-known authority on the birds of Africa.

It is a great satisfaction to all who have had occasion to work on African collections to have available Sir Frederick's extended observations covering over thirty years of field work. He regarded himself as a field naturalist rather than a scientist and his hope was that his work might help others to carry on in the same line. As Dr. Sclater has said, the systematic side of East African bird study has been practically completed and there are but few species or subspecies to be described but "in the matter of nesting habits, migration and distribution there is a vast opening for the field naturalists of the future to increase our knowledge of Kenya bird life," and the present work will be a great aid and stimulus to this end.

The work appears in three sumptuous royal-octavo volumes. There are brief introductory chapters, a sketch of the origin and distribution of the avifauna of Kenya and Uganda, a gazetteer of localities and a bibliography. The main text treats of 1393 species and subspecies (if our count be correct) 987 of which are Passeres. Under each form there are paragraphs on description, distribution, recorded localities, and notes. The last, comprising the author's observations and field notes, are by far the most extensive and important. Dr. Sclater has prepared a number of the descriptions as well as the diagnoses of genera and families and the keys, while he has brought the entire manuscript up to date. The classification and nomenclature follow the 'Systema Avium Aethiopicarum' with the addition of certain forms described since its appearance. The synonymy is very brief and the references are selected for their importance with no thought of making them complete. The illustrations comprise twenty-four colored plates from paintings by George Lodge which possess high artistic merit, a portrait of Sir Frederick Jackson and 241 text-figures in line or half-tone by H. Grönvold.

Jackson has the happy faculty of combining his accounts of the birds with sketches of their environment which often present vivid pictures. Speaking of his visit to Lake Hannington in 1900, where at least a million Flamingoes were assembled, he writes, "It certainly was a sight that baffles description. It was in the early morning before the wind rose and the water was like glass. The foreshore was deceptive, as a smooth, firm-looking, sun-baked crust hid a most offensive mixture of mud, sand, guano, and rotting vegetable matter several inches in depth and an attempt to

¹ The Birds of Kenya Colony and the Uganda Protectorate. By Sir Frederick John Jackson, K. C. M. G., C. B. Completed and edited by W. L. Sclater, M. A. Vol. I (Struthionidae to Psittacidae, pp. i-ixviii + 1-544, pls. 1-10, 115 text-figures); Vol. II (Coracidae to Sylviidae, pp. 545-1136, pls. 11-18, 61 text-figures); Vol. III (Hirundinidae to Emberizidae, pp. 1137-1558, pls. 19-24, 61 text-figures and a map). Gurney and Jackson, 98 Great Russell St., London W. C. 1; Tweeddale Court, Edinburgh, 1938. Price £4, 10s. net.

approach nearer to the birds was completely defeated. From the higher ground we enjoyed a much better view, and Sir Clement Hill correctly described it as 'a mirror set in a pink frame'; and that was just what it was like. On our side to the right and left of us, the frame varied in depth according to the extent of the shoals, from six feet to a hundred yards or more. At the north where the area of shallow water was greatest, the frame widened to at least half a mile in depth—all birds."

Of the short-tailed Bateleur Eagle he says, "It is one of the most striking of the land birds, its shape, its coloring and its flight all combining to attract attention; but the last is the most remarkable. It is little less than albatross-like in its power of sustained motion without any visible movements of the wings. Momentum is apparently maintained by canting one side or another, and at the same moment either slightly dipping or turning right or left—the wings, except the tips, being apparently as rigid as an aeroplane's."

The work is an attractive piece of book making and credit is due to all concerned in its production.—W. S.

Halle's 'Birds against Men.'—Although the author of this book makes no pretense of being a technical ornithologist, one has but to read a few pages of his latest work¹ to realize that the writer entertains a deep interest in the life histories, activities and environment of the birds with which he has come in intimate contact. Also, one quickly is impressed with the keenness of the author's power of observation, with the patience exhibited in his field work, and with his very marked ability in selecting words to give the exact shade of meaning he desires to express.

This book will entertain discriminating readers, regardless of whether or not they care particularly about birds. Mr. Halle's accounts of his observations of the behavior of birds easily carry the reader onward from page to page. His sanely emotional comments on a merganser in his bath-tub, the courtship and fortunes of a family of Red-tailed Hawks, the daily life of a Kingbird, the behavior of a dignified parrot, glimpses of the birds that throng the jungles about the Mayan ruins of Guatemala,—all arouse the hope that this gifted young man will long continue to write such books.

Evidently he seeks to acquaint himself with authoritative literature on the subjects he discusses, and has been careful to use the approved vernacular names for his birds,—the one oversight noticed is where he mentions the Blue Jay as "bluejay."

The book consists of some 217 pages of actual text, divided into seven chapters, each in itself a complete essay. There are seven full-page illustrations and two or three tail-pieces. All are very sketchy and ineffective line drawings. "Birds against Men" is a vague and inapt title for this very commendable volume.—T. GILBERT PEARSON.

John Muir's Journals.—The appearance of hitherto unpublished subject matter on birds from the pen of John Muir will be welcomed with pleasure everywhere by a steadily growing multitude of readers who in the past have been charmed by his delightful word pictures of the various phases of bird activity observed by him in his explorations; and, as would be expected, these newly published daily journals² contain some additional data on this—one of his favorite topics. It appears that no original manuscript journals survive from his boyhood nor from his four years' study at the University of Wisconsin, if, indeed Muir wrote any. Likewise, none has been

¹ *Birds against Men* | By Louis J. Halle, Jr., with drawings by Lynd Ward. 8vo, 228 pages, 7 plates; The Viking Press, New York. Price \$2.50.

² John of the Mountains: the unpublished journals of John Muir. Edited by Linnie Marsh Wolfe. 8vo, 459 pp., illus., Boston, Houghton Mifflin Company, 1938. \$3.75.

found which records his early botanical ramblings in Canada. It was, however, about the period 1864-66 that he began the well-known and remarkable series of letters to a friend, Mrs. Jeanne C. Carr, wife of Dr. Ezra Slocum Carr of the University faculty, herself a botanist, who had persuaded him to write her of his findings. Having this preliminary practice in the art of self-expression, he wrote his first journals in 1867, recording what he saw as he made his now famous "Thousand mile walk to the Gulf," journals which were edited and published under that title shortly after his death. His first California journals, written in 1869, form the first chapter of the present book, and the succeeding chapters contain most of the important journals which followed, with the exception of his foreign-travel journals which, regrettably, had to be omitted from this book. The journals as here published, therefore, cover nearly the whole of his career as a naturalist, narrating his wanderings, describing what he saw, and recording his scientific researches. In all, there are sixty manuscript volumes extant of Muir's journals, and, closely allied with them, there is a mass of notes scribbled upon loose sheets and bits of paper of all shapes and sizes.

These notes, mostly written in pencil, having shared the hardships of many of his wanderings, are not easy to read after the lapse of years. Many doubtless were scribbled by flickering camp-fire light when his fingers were numb with cold or fatigue; or, perhaps, in the dark lee of some boulder or tree while storm raged about; or, while tramping over some vast glacier, his eyes fairly blinded by snow glare. Often before these notes could be brought in to camp or hut, they were smudged by ferns and flowers pressed between their pages, or, perchance, water-soaked in bogs that had to be waded through. Rich in diction and flowing abundantly out of his sheer undimmed joy in living, these contemporary entries and fragments are largely devoted to an expression of his inmost thought upon Nature and her transcendental meanings. Even in some of the earlier of these he reveals a surprising mastery of poetic prose, and throughout he shows an exquisite sensitiveness to the beauty of rhythmic language. Perhaps, as measured by present-day standards of excellence in technical writing, some of his bird notes might be lacking somewhat in scientific exactness, but he had a vocabulary saturated with the poetry of Burns and Milton and the King James version of the Bible much of which he had learned by heart when a child, and all of these lent an unconscious music to his own written words. So, in these journal entries, we read with increasing pleasure his successive notes, often fragmentary but always interesting, concerning his good friends the albatross, the bluebird, the bobolink and the snow bunting, and, along with them, perhaps in the same paragraph, of his equally good friends the boulders, the waterfalls, the caves, the cataracts and the avalanches. With notes on the chickadee, the crane, the finch, the grouse and the flicker, perhaps, may be interspersed a paragraph or two of meditation on Beauty as a synonym of God, or on the glories of Indian summer. Along with that on the eagle, the egret, the heron, the killdeer, and the linnet, there may be discussion of Nature's use of smoke, or of the fragrance of the primitive forest, or, perhaps, on the unpoetical character of sheepherding or on the purity and spirituality of the great out-of-doors. The meadowlark, the mockingbird, the plover and the sage hen may share honors in his records with his mental reactions to the rainbow colors of waterfalls or the action of earthquakes on slate. An actual count made by this reviewer revealed that sixty-eight species of birds are mentioned or discussed with varying degree of fullness. The temptation is great to make copious quotations from some of these entries, but, regrettably, limitations of space forbid more than one brief, highly characteristic excerpt from record of a solitary tramp in 1870 through Merced Canyon in the Sierras: ". . . feelings of isolation soon caught me

again among these hushed sounds, but one of the Lord's smallest birds came out to me from some bushes at the side of a moss-clad rock. It had a wonderfully expressive eye, and in one moment that cheerful, confiding bird preached me the most effective sermon on heavenly trust that I had ever heard . . . and I went on not half so heart-sick nor half so weary."

The book is a delightful one and its reading is heartily commended.—J. S. WADE.

Bird enemies of forest insects.—In a recent English text,¹ seven pages (259-266) are devoted to birds as enemies of forest insects. German opinion is cited that the cuckoo, starling, tits, and finches, especially the Chaffinch, in the order named, are the most useful species in controlling forest insect pests. The Jay, Wood-pigeon, and Greater Spotted Woodpecker also are mentioned and instances of the good work of each are noted. A great deal has been done in Germany to encourage birds in forests and nest boxes and feeding places have become a regular feature in most parts of the country. "Woods thus supplied have, in certain cases, shown remarkable immunity from pests such as the nun moth, and oak-roller moth, while neighboring woods, unprotected have suffered severe damage." The material on British birds is largely from St. Clair Thompson's book, 'The Protection of Woodlands,' 1928 (reviewed in 'The Auk,' 46(1): 143-145, Jan. 1929).

The author remarks, on his own account, however that, "the encouragement of bird-life in our forests . . . should receive more detailed study from the practical point of view than it has received hitherto" and "the study of the question as to the best means of encouraging the bird-life in our coniferous areas is one which demands immediate attention." Experience in Czechoslovakia indicates that this requires maintenance of clearings, where bird-attracting facilities may be effectively installed. Those already in use appear to have remarkable value as rallying places for bird life.—W. L. M.

Darling's 'Bird flocks and the breeding cycle.'—In this very readable little book,² which one may finish in an evening's leisure, the writer briefly presents some of the results of his intensive study of the seabird colonies at lonely little Priest Island off the northwest Highlands of Scotland. Here, quite undisturbed, it was possible for two whole seasons, to follow the normal activities of various species.

A preliminary chapter discusses the recent developments in our knowledge of the part played by ultra-violet light and by visual stimulation on the ripening of the reproductive glands, in which it is now known that the gonad-stimulating hormone of the pituitary body is the important factor. It is further evident that a necessary psychical factor is provided by the presence of another individual and by the attitudes of this companion. The important point which the author endeavors to bring out is that if the posturing of a companion bird (whether of the opposite sex or of a similar species) may induce the initiation of responses leading to coition and reproduction, it is quite conceivable that in colonial birds the presence and actions of others of the group as a whole may likewise become essential to the completion of the cycle. The body of the book is devoted to further elucidation of this point, from a study of the four species of gulls that breed at Priest Island, namely, the Herring Gull, Common Gull, the Lesser and the Greater Black-backed Gulls. The requirements of each of these differ, and are given in most detail for the Herring Gull and the Lesser Blackback in which the general aspects of the cycle are traced.

¹ Chrystal, R. Neil. *Insects of the British Woodlands*. 338 pp., 32 pls., 1937; F. Warne & Co., London, England. 7s. 6d.

² Darling, F. Fraser. *Bird flocks and the breeding cycle* [a contribution to the study of avian sociality]. Small 8vo, x + 124 pp., frontispiece; The University Press, Cambridge, England, and The Macmillan Company, 60 Fifth Ave., New York City. \$1.75.

An important point brought out is that the various groups of each species may begin nesting at slightly different times, that the larger groups of colonies of nesting birds are the earlier and the more successful, partly because the members of the flock by their common courtship activities tend to show a greater synchronization in nesting with the result that young, which in the downy stage are especially open to attack, are thus exposed to a less extended period of persecution. Small colonies may even prove altogether unsuccessful in rearing young to the fledged stage.

The latter part of the book is devoted to a condensed account of courtship, particularly of a communal type, among seabirds of the island and concludes with new light on the significance of numbers in relation to social behavior. Numerous instances are adduced of the budding-off of new colonies from larger parent groups. As a single example, three pairs of Razor-billed Auks in 1936 visited the west coast of the island and took up positions on a cliff, but did not breed. In the following year nine birds at first arrived and later the group increased to fourteen and then commenced to display an interesting type of communal courtship. This was followed by nesting. The author believes that in this and in similar instances, the number of birds was at first too small a company to arouse an efficient stimulus to breeding. Thus it may be that there is a more or less definite threshold of numbers necessary to provide the requisite social atmosphere, without which communal courtship and nesting may not take place. In this may perhaps be found the reason for the failure of a social species to maintain itself by reproduction when reduced to small groups numerically below the social threshold.

The book concludes with a list of references and an index. There is an interesting frontispiece of a Fulmar 'visiting' another member of the colony, a common social act. Here is a very interesting and suggestive book, with much new matter that forms a valuable contribution to our knowledge of the social life of these seabirds.—G. M. A.

Priestley's 'Book of Birds.'—Reading this book¹ brings clearly to view the fact that the appreciation of birds is quite as legitimate an aspect of the field of ornithology as are systematics or physiology; for the appeal of birds to the human mind manifests itself in many different ways. Their activity, familiarity, beauty and variety stimulate us to manifold reactions often of an unsuspected nature, giving to some a desire for closer understanding of their ways, to others a zeal for collecting or comparison, to others again an urge to poetic expression, all of which are but differing effects that these fellow creatures exert upon our own consciousness. From an aesthetic aspect birds may cause us to consider abstract things and intangible qualities with which they become associated in our minds. The compiler of this anthology, therefore, needs no excuse for bringing together as a "companionable book" this collection of extracts about birds culled from many sources in the course of interested reading. First attracted to birds by the appeal of the bright colors of a flock of gold-finches, she began to read the writings of various authors on birds and made a scrap-book of extracts on the subject. These finally amounted to such an interesting whole that it seemed worth while to pass them on for the pleasure of others.

Naturally the greater part of these extracts come from English writers and poets, old and new—Gilbert White, Hudson, Alfred Russel Wallace, Julian Huxley, Edgar Chance, Robert Lynd, Shakespeare and Keats—to mention but a few; now and then, however, an American author, whose literary charm or descriptive art seems worthy, is included—Audubon, Thoreau, Sutton, Peattie. One wonders why Shelley's

¹ Priestley, Mary. A book of birds. With 82 wood engravings by C. F. Tunnicliffe. sm. 8vo, 384 pp., illus.; Macmillan Co., New York City. \$2.50.

verses on the Skylark were omitted, but perhaps these are sufficiently familiar. There is no attempt at anything more than variety or the selection of well-written and interesting bits in the choice, hence there is no obvious structure or plan to the book—owl, pelican, redwing and rook follow in sequence—but the selections are good though apparently limited to the compiler's browsing range. Over ninety different authors appear, some of them many times, while the quotations cover a wide field of geography from the British Isles to Antarctica.

The numerous illustrations are from modern wood engravings showing different familiar birds, but although the modern style of 'woodcut' is by many regarded as a high development of the illustrator's art, to the reviewer's taste the heavy lines, dark shadings and blacks are inappropriate to the illustration of most birds except crows and ravens. There are good indexes to the authors and species found in the text.

Here is an unusual type of popular bird book which should have much appeal to the general reader.—G. M. A.

Brooks's Bibliography of West Virginian Ornithology.—With the ever-increasing output of ornithological literature, any bibliographical summary covering some aspect of the field is welcome and worth while. The compiler of this list¹ has for many years kept close track of the publications on West Virginian ornithology and has himself contributed many valuable notes and more extended articles on the birds of the State, so that he is in an excellent position to prepare the present thorough catalogue of pertinent literature. The references are arranged chronologically, year by year, beginning with 1831 and carrying the subject to the early part of 1938. Instead of the more usual method of citing first the title of the article or book, followed by the volume, and pages, the procedure is here reversed, citing first the name of the journal, then volume and page, followed by the quotation of the title with brief comment on the value and scope of each article. There is often a lack of consistency in the method, some titles are omitted or the reference is incomplete, although the essentials are there. The use of Roman numerals for volume numbers might have been avoided since they not only take up more room but involve a mental translation with consequent liability to error. Of especial value are the comments following the titles, for the author's familiarity with the birds of the State enables him to make helpful appraisal of the many contributions; while the inclusion of articles from various minor journals, some long defunct, makes available many notes that might otherwise easily be overlooked. The chronological arrangement has the advantage that it permits the student to follow the development of the ornithological history of the State. The list of references is 'lithoprinted' in double column, a method which simulates clear typewriting and is adapted to the use of good paper the size of a typewriter sheet. The title page and cover are type-set and the whole is neatly bound in stiff buff covers. It should be helpful to all who are interested in the ornithology of the region it covers.—G. M. A.

Gladstone on 'Thomas Watling, limner of Dumfries.'—As the personalities of the earlier naturalists recede into the past, it becomes a matter of increasing interest as well as of difficulty to retrieve what at this distance may still be found out concerning them. This attractive little book² presents the results of a five-year search for particulars of Thomas Watling, one of the first artists to portray the fauna

¹ Brooks, Earle Amos. A descriptive bibliography of West Virginia ornithology. Large Svo, 28 pp., published by the author at 166 Plymouth Road, Newton Highlands, Mass., April, 1938. Price \$1.00.

² Gladstone, Hugh S. Thomas Watling | Limner of Dumfries. Svo, 75 pp., 7 pls., reprinted for private circulation, from the Trans. Dumfriesshire and Galloway Nat. Hist. and Antiquarian Soc., Dumfries, 1938.

of New South Wales at first hand. It appears that he was a limner or painter of Dumfries, Scotland, who in 1789 was arrested on the charge of having forged notes of the Bank of Scotland. Although he seems to have protested his innocence, nevertheless, believing that the notoriety of the affair would be damaging to his career at home, he accepted a penalty of fourteen years' 'transportation,' to Port Jackson, New South Wales, then a penal colony. Little record of him exists; even the date of his birth is uncertain, though an entry of his baptism in 1762 was unearthed. On his way out to the Antipodes in the ship 'Daedalus' he managed to escape when the vessel touched at Cape Town, where, however, he was later recaptured, and forced to continue the journey in another ship. Two letters which he wrote to his aunt in Dumfries, were afterwards published anonymously as a small book, entitled 'Letters from an exile at Botany-Bay, to his aunt in Dumfries.' Subsequent petitions from this lady, Marion (or May) Kirkpatrick, failed to secure his release. But while in New South Wales he was employed by 'J. W.'—doubtless John White, author of the 'Journal of a Voyage to New South Wales,' 1790—to paint "the non-descript productions of the country." He even conceived the idea of himself publishing a book on the new country, to be illustrated by his paintings, but apparently his employer made use of these latter for his own purposes. There is evidence that Latham, in the Second Supplement to his 'Synopsis' and in his Supplement to the 'Index Ornithologicus,' made use of a number of Watling's drawings for the description of new species. Mr. Gladstone shows, however, that there are in existence three portfolios of water color drawings ascribed to Watling: two in the British Museum and one in the Mitchell Library at Sydney. One of those in the British Museum alone contains signed drawings by this artist, while the other in that institution apparently has none of his work; the Sydney set is probably the work of several artists none of whom is certainly identifiable. The first of these sets is the one used by Latham, and is mentioned as 'Mr. Lambert's drawings,' but it includes the work of two or three other artists as well. As to the origin of its Watling's drawings, the author demonstrates that John White was in correspondence with Lambert and he believes that many of the paintings sent to Lambert by White were the work of Watling, annotated by his superiors, but with a complete disregard of the artist.

The new facts here brought to light by this painstaking investigation thus clear up a number of points in regard to Thomas Watling and his work, but raise additional and perhaps insoluble questions concerning the actual source of work previously ascribed to him. The involved nature of the whole matter is reflected in the general presentation and discussion, from which the reader finds difficulty in arriving at the final conclusions, a difficulty which the author might perhaps have obviated by adding a clear summary of his findings.—G. M. A.

'Native Bird Songs.'—This is one of the latest records of bird songs to come from the Cornell Ornithological Laboratory where Mr. Brand has made such noteworthy contributions to the methods of recording wild bird songs. This record¹ is far superior to any of the older recordings which have been on the market. The following birds are included, each with a representative variety of songs and call notes: Hermit Thrush, Wood Thrush, Brown Thrasher, Whip-poor-will, Field Sparrow, Phoebe, Black-capped Chickadee and Loon. Between the various songs are inserted vocal explanations and descriptions; and, as is natural in a commercial record, these comments are designed for the average layman rather than for those already familiar with the birds' songs.

¹ Native Bird Songs. Recorded from Nature by A. R. Brand and the Laboratory of Ornithology, Cornell University. Victor record No. 25765.

At some points, the records are startlingly realistic. Sitting in an easy-chair, one almost sees the sunset reflected in the quiet waters as the Loon sends his echoes rolling back and forth across the mountain lake; and when the Whip-poor-will breaks the stillness of the evening one can fairly feel the dew on the grass—and the bites of the mosquitoes. Background noise has been reduced to a minimum in this record, presumably by a painstaking selection of the best songs from a vast number of recordings. In fact the mechanical noise from any but the very best of phonographs is louder than any extraneous noises originating in the record itself. A more serious limitation on recordings of bird notes is imposed by the fact that very few commercial pick-ups will reproduce notes of higher pitch than about 3000 vibrations per second. For after the record has been played a few times with steel needles, the weight of the head has marred the delicate contours of the groove which reproduce the higher frequencies. Since many bird songs have a considerable component of higher frequency than 3000 cycles, this causes some distortion, even though the records may originally have been almost perfect. This, however, is a defect of our phonographs, and has nothing to do with the most excellent recording which Mr. Brand and his associates have accomplished. No ornithologist can consider himself up to date in his knowledge of bird-song recordings who is not familiar with these records.—D. R. GRIFFIN.

Menegaux's 'Oiseaux de France' is the thirty-first of a series of small popular handbooks of natural history, issued by Paul Lechavalier of Paris. Of this work, projected to form four volumes, the present¹ is the third, and covers the "Ordre de Coraciiformes" (in which the author chooses to include the rollers, kingfishers, bee-eaters, hoopoe, nightjars and swifts) and part of the "Ordre de Passeriformes," taking in the swallows, Old World warblers, wrens, waxwing, grass warblers, shrikes and thrushes. The fourth volume will include the remaining passerine species. The volume here noticed, consists of two parts. In the first, paged in Roman numerals, are the diagnoses of orders, families and genera, followed in each case, where there is more than one species in France, by a key. The second part, paged in Arabic numerals, consists of an atlas of sixty-four colored plates, and additional plates in black and white from drawings or from photographs. In the first part many of the species are listed by name only, with a reference to the plate in the atlas, where, on a facing page, is found the particular account, giving French and Latin name, names in other languages, brief description of plumages, measurements and biology. In the case of the unfigured species, this matter is usually placed in the first part following the name. There is thus a confused arrangement, making it at first difficult to find the desired account, while a supplement to the text of the plates at the back of the book, further aggravates the trouble. However, there is a table of contents and an index. The colored plates are by Eudes and in most cases show the male and female and as an inset in one corner, the egg, of each bird. Although some of the subjects look as if drawn from poorly mounted specimens and most of the poses are stiff, yet the delicacy of coloring and composition and the indications of the habitat of each have a certain charm such as only a French artist could give, and this goes far to make up for any shortcomings. As a popular and inexpensive handbook of the birds of France this rather attractive little set should prove useful to amateur field ornithologists in identifying their native species.—G. M. A.

¹ Menegaux, A. *Les Oiseaux de France. Volume III Passereaux (tome II). Encyclopédie Pratique du Naturaliste XXXI.* Sm. 8vo, pp. dix-dxiii; atlas, pp. 144-267, 1937. Paul Lechavalier, ed., 12 rue de Tournon, Paris 6e. Price 60 fcs.

PERIODICAL LITERATURE

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DUNCAN, A. B. The Magpie in Scotland. The Scottish Naturalist, no. 231: 65-79, 1938.

ELIOT, SAMUEL A., JR. Spring in the [Connecticut] Valley. Bull. Massachusetts Audubon Soc., 22: 4-6, June 1938.

ENDRIGKEIT, A. Fressen Haubentaucher Frösche oder Froschlarven? Journ. f. Ornith., 86: 251-254, fig. 1-2, Apl. 1938.—The Crested Grebe is shown to be the host of a parasitic trematode, *Tylodelphys clavata*, which is smaller than the allied *excavata*, a parasite of the Stork. The intermediate hosts of both are fish, rather than frogs.

ERICKSON, MARY M. Territory, annual cycle, and numbers in a population of Wren-tits (*Chamaea fasciata*). Univ. of California Publ. Zool., 42: 247-334, 16 figs., pls. 9-14, 1938.

ERRINGTON, PAUL L., AND HAMESTROM, F. N., JR. Observations on the effect of a spring drought on reproduction in the Hungarian Partridge. Condor, 40: 71-73, Mar. 15, 1938.—Retardation and decrease in productivity resulted.

EVANS, CHARLES. A Bittern uses its coloration. Flicker, Minneapolis, 10: 5, May 1938.

FABRICIUS, ERIC. Några iakttagelser rörande viggens, *Nyroca fuligula* (L.), beroende av måsfäglarna såsom häckfågel i skärgården. Ornis Fennica, 14: 115-125, 1937 (with German abstract).—This duck in southwestern Finland was found to nest usually on islands where colonies of terns were breeding, because, as the author suggests, the latter afford a certain protection in driving off marauding crows and other nest-robbers. A similar habit was noted in the case of eiders and scoters.

FALLA, R. A. Crested Penguins in Western Australia. Emu, 37: 197-200, 1 fig., Jan. 1, 1938.

FINLAYSON, H. H. Notes on some birds seen on Flinders and other islands off the Eyre Peninsula coasts, February–March, 1937. *So. Australian Ornithologist*, **14**: 141–146, Apl. 1, 1938.

GARLING, MAX. Einige Bemerkungen über die Brutvögel der Berliner Rieselfelder. *Beitr. z. Fortpflanzungsbiol. d. Vögel*, **14**: 13–20, Jan. 1938.

GIADKOV, N. A. Die adaptive Bedeutung der Alula bei den Vogeln. *Bull. Soc. des Naturalistes, Moscou, sect. biol., new ser.*, **46**: no. 5, 272–279, 8 figs., 1937.—In Russian with German resumé. The function of the alula is to increase the lifting power in flying up, and in alighting, and is analogous in effect to the aileron at the front edge of the wing of an airplane.

GORDON, SETON. Incubation-period of the Peregrine. *British Birds*, **32**: 18, June 1, 1938.—A set of four eggs completed April 15 showed on May 18 two newly hatched young and one egg. The hatching took place five weeks after the laying of the first egg.

GRANT, C. H. B., AND MACKWORTH-PRAED, C. W. [On the status of *Viridibucco simplex* and *V. leucomystax*.] *Bull. British Ornith. Club*, **58**: 77–78, Mar. 4, 1938.—Additional specimens from Tanganyika Territory and Kenya Colony confirm the specific distinctness of these birds.

GRANT C. H. B., AND MACKWORTH-PRAED, C. W. [On the status of six African birds.] *Bull. British Ornith. Club*, **58**: 82–84, Apl. 4, 1938.—*Barbatula kandti* is a synonym of *B. b. jacksoni*; *Barbatula leucolaima urungensis* is a synonym of *B. b. nyansae*; *Lybius guifsobalito ugandae* and *Lybius melanopterus didymus* are untenable; *Buccanodon belcheri* is a race of *B. olivaceum*; the type locality of *Trachyphonus erythrocephalus shelleyi* is Goolis Mountains, British Somaliland.

GRANT, C. H. B., AND MACWORTH-PRAED, C. W. [On African birds.] *Bull. British Ornith. Club*, **58**: 116–119, May 27, 1938.—*Pogoniulus bilineatus conciliator* becomes a synonym of the typical race; three races of *Trachyphonus erythrocephalus* are recognized; on the type localities of *Indicator variegatus* and *I. minor*, of the latter of which *I. m. teitensis* is made a synonym.

GREEN, WILLIAM E., AND HENDRICKSON, GEORGE O. The European Partridge in north-central Iowa. *Iowa Bird Life*, **8**: 18–22, fig., June 1938.—Increase in recent years.

GRINNELL, JOSEPH, AND BEHLE, WILLIAM H. A new race of titmouse, from the Kern Basin of California. *Condor*, **39**: 225–226, 1937.—*Baeolophus inornatus zaleptus* subsp. nov.

GRISCOM, LUDLOW. A phenomenal spring migration. *Bull. Massachusetts Audubon Soc.*, **22**: 1–3, June 1938.—In eastern New England, 1938.

GROTE, H. Die Vögel von Franz-Joseph-Land. *Beitr. z. Fortpflanzungsbiol. d. Vögel*, **14**: 1–8, Jan. 1938.—List of the twenty-six species recorded from the island, of which fourteen are known to breed there.

GUIMARAES, L. R., AND LANE, FREDERICO. Contribuições para o conhecimento das Mallophagas das aves do Brasil. VI.—Novas espécies parasitas de Tinamiformes. *Revista do Museu Paulista*, **23**: 1–21, pls. 1–4, Aug. 30, 1937.—Describes four new species and two new races of Mallophaga from South American tinamous.

HAARTMAN, LARS VON. Till kändedomen om viggens, *Nyroca fuligula* (L.), häckningspsykologi i skärgården. *Ornis Fennica*, **14**: 125–134, 5 figs., 1937 (with German abstract).—On the breeding psychology of this duck in associating with terns and gulls for protection from egg-robbing species.

HACHISUKA, THE MARQUESS. [A new Kaleege Pheasant, *Gennaeus moffitti*.] *Bull. British Ornith. Club*, **58**: 91–93, May 12, 1938.—Described from aviary specimens believed to have come from southern Tibet.

HARVEY, W. O. The East African Pitta (*Pitta longipennis* Reichenow). *Ibis*, (14) 2: 335-337, Apl. 1938.—Distribution, status and habits.

HAVERSCHMIDT, FR. Einige Beobachtungen über das Brutgeschäft des Kleinen und Grossen Buntspechts. *Beitr. z. Fortpflanzungsbiol. d. Vögel*, 14: 9-13, Jan. 1938.—Breeding habits of these woodpeckers.

HERRICK, EARL H., AND TORSTVEIT, OLAF. Some effects of adrenalectomy in fowls. *Endocrinology*, 22: 469-473, 4 figs., Apl. 1938.—Conclude that the adrenal glands have an important effect in maintaining the testes.

HICKEY, JOSEPH J., AND WILCOX, LEROY. On the nesting of the Black Skimmer in New York State. *Proc. Linn. Soc. New York*, for 1936: 98-99, Oct. 31, 1937.—The discovery of a nesting pair off Fisher's Island with a single egg on August 11, 1919, is now confirmed. On July 31, 1936, a group of five pairs was nesting at Moriches Inlet.

HITCHCOCK, W. B. Late nesting notes, etc. *So. Australian Ornithologist*, 14: 151-153, Apl. 1, 1938.

HOESCH, W. Ornithologische Beobachtungen auf einer Fahrt ins Etoscha-Gebiet (SW. Afrika). *Journ. f. Ornith.*, 86: 222-233, 7 figs., Apl. 1938.—Brief notes on birds of the desert region of Southwest Africa.

HOWARD, HILDEGARDE. The Rancho La Brea Caracara: a new species. *Carnegie Inst. Washington, Publ. no. 487*: 217-240, 3 pls., July 7, 1938.—Numerous remains now indicate the distinctness of the Rancho la Brea bird, here named *Polyborus prelulosus*.

HUDSON, GEORGE E., AND OTHERS. Some recent range extensions of the European Starling in Nebraska. *Nebraska Bird Review*, 6: 4-7, Apl. 20, 1938.—Brief notes by various contributors on recent extension of range in Nebraska.

HUEY, LAURENCE M. A species [*Puffinus tenuirostris*] new to the known avifauna of Lower California. *Condor*, 40: 128, May 17, 1938.

HUEY, LAURENCE M. Frank Stephens, pioneer. *Condor*, 40: 101-110, fig. 31-32, May 17, 1938.

INONE, M. On the breeding of *Sitta europaea clara* Stejneger. *Tori, Bull. Ornith. Soc. Japan*, 9: 473-477, fig. 152-155, Dec. 1937 (Japanese text).

IREDALE, TOM. The question of species. *Emu*, 37: 179-181, Jan. 1, 1938.

JAMES, RICHARD. Breeding British birds. *Avicult. Mag.*, (5) 3: 141-143, May 1938.—Redpoll steals nest material; Bramble Finch would swallow canary chicks whole.

JOURDAIN, F. C. R. Share of sexes in incubation of the Dipper. *British Birds*, 31: 380-381, May 1, 1938.—Female normally alone incubates.

KAZANO, T. Two new records of birds from Formosa. *Tori, Bull. Ornith. Soc. Japan*, 10: 10-13, fig. 1-4, June 1938 (Japanese text).

KEY, HILTON J. A Little Falcon (*Falco longipennis*) kills a bat. *So. Australian Ornithologist*, 14: 122, Jan. 1, 1938.—One of a colony of bats flushed from their retreat was caught in midair; other diet.

KINNEAR, N. B. [A new race of babbler from southeastern Tibet.] *Bull. British Ornith. Club*, 58: 76-77, March 4, 1938.—*Babax lanceolatus lumsdeni*, Charme district.

KINNEAR, N. B. [A new name, *Stachyris guttata tonkinensis*, proposed for *Thriporhina guttata diluta* Kinnear.] *Bull. British Ornith. Club*, 58: 82, Apl. 4, 1938.

KOZLOVA, E. V. Field observations on the breeding of the Herring-Gull (*Larus argentatus ponticus*) on the Caspian Sea. *Ibis*, (14) 2: 245-254, pls. 3-4, Apl. 1938.—Habits of adults and young.

KURODA, N. Notes on the Java Sparrow. *Tori, Bull. Ornith. Soc. Japan*, **9**: 478-483, pl. 9, Dec. 1937.—Plate in color illustrating seasonal changes.

KURODA, N. On a melanistic example of *Tribura luteoventris* from Formosa. *Tori, Bull. Ornith. Soc. Japan*, **10**: 3-9, pl. 1, June 1938.—With English resumé; the colored plate shows normal plumages of young and adult, and a dark-breasted individual.

KURODA, N. Ducks of Lake Ashi, Hakone, Hondo. *Tori, Bull. Ornith. Soc. Japan*, **10**: 37-40, fig. 6, 7, June 1938.

LINSDALE, JEAN M. Observations on waterbirds in California. *California Fish and Game*, **24**: 1-43, 8 figs., Jan. 1938.—The State can no longer carry the same number of waterfowl as when it was first settled. Suggestions for improvement of present conditions.

LOW, CARMICHAEL. [Pheasants and a partridge showing perversion of plumage.] *Bull. British Ornith. Club*, **58**: 86-88, May 12, 1938.—In females showing male plumage, degenerative or pathological changes were found in the ovary. It is believed that when the ovarian hormone disappears a testicular one, due to development of testicular tissue, takes its place. The reverse, a male taking on female plumage, may be the result of a partially hermaphroditic condition.

LOWE, PERCY R. Some anatomical and other notes on the systematic position of the genus *Picathartes*, together with some remarks on the families Sturnidae and Eulabidae. *Ibis*, (14) **2**: 254-269, pls. 5-6, figs. 2-3, Apl. 1938.—This bald-headed bird of the forests of the Gold Coast and Cameroons, West Africa, proves to be a starling rather than a crow. The author divides the Sturnidae into four subfamilies, of which this bird constitutes a member of the Picathartinae. To this subfamily belong *Sarcops* of the Philippines, *Mino* of New Guinea, and *Creatophora* of East Africa and Arabia. Here is another case of affinity between a West African and a far-Eastern species.

LOWERY, G. H., JR. A new grackle of the *Cassidix mexicanus* group. *Occas. Papers Mus. Zool.*, Louisiana State Univ., no. 1, 11 pp., May 4, 1938.—Describes as new the Mesquite Grackle, *Cassidix mexicanus prosopidicola* of the Gulf Coast of southeastern Texas and northeastern Mexico.

MACDONALD, J. D. Systematic notes on some African barbets. *Ibis*, (14) **2**: 346-349, Apl. 1938.—Lists the races and distribution of races of *Pogonornis chrysocomus* and *Lybius undatus*.

MACKWORTH-PRAED, C. W., AND GRANT, C. H. B. Systematic notes on East African birds.—Part XVIII. *Ibis*, (14) **2**: 333-335, Apl. 1938.—On the races of *Strix woodfordii* and on the distribution of the Orange Thrushes.

MACPHERSON, A. HOLTE. Birds of inner London. *British Birds*, **31**: 372-375, May 1, 1938.

MARSHALL, A. J. On the occurrence of *Larus marinus* in Spitsbergen. *Ibis*, (14) **2**: 341-342, Apl. 1938.—A lone bird taken in late July at Klass Billen Bay.

MANGELS, FREDERICK P. Colored bands. Methods for using bands and arranging data. *Bird-banding*, **9**: 94-97, 6 figs., Apl. 1938.

MATHEWS, GREGORY M. Overlooked names of European birds from the 'Analyst' and from the 'Ornithological Guide.' *Ibis*, (14) **2**: 321-331, Apl. 1938.—In these two rare works many new names were proposed, some of which prove to be valid.

MAUVE, LUTZ. Der Zug der Grossvögel über den Bosporus. *Journ. f. Ornith.*, **86**: 261-301, 9 figs., Apl. 1938.—The region of the Bosporus is traversed in migration only by those raptorial birds and storks that naturally avoid crossing large bodies of water (as the Mediterranean Sea), and in this the peculiar conformation of the

land causing favorable upward currents makes it of especial attraction to soaring species. The various factors involved are discussed and illustrated by maps and diagrams. Noted by Belonius nearly four hundred years ago.

MAXWELL, P. H. Bernstein's Ground-cuckoo (*Centropus bernsteini*). *Avicult. Mag.*, (5) 3: 125, pl., May 1938.—Photograph of a live bird from New Guinea in the London Zoo.

MAYAUD, NOËL. Some notes on shearwaters. *Ibis*, (14) 2: 343-345, Apr. 1938.—No *P. yelkouan* has yet been recorded from the Atlantic.

MAYR, ERNST. The birds of the Vernay-Hopwood Chindwin Expedition. *Ibis*, (14) 2: 277-320, Apr. 1938.—Lists the birds secured in Upper Burma. New forms described are: *Rhopodytes tristis saliens* (Chapa, Tonkin) and *Caprimulgus macrurus hainanus* from Cheteriang, Island of Hainan.

MEINERTZHAGEN, R. [Four new birds from Asia.] *Bull. British Ornith. Club*, 58: 94-96, May 12, 1938.—New are: *Aegypius monachus danielli* from Changai, Mongolia; *Parus rufonuchalis blanchardi* from Gardez forest, Afghanistan; *Erythrina synoica salimalii* from Akrobat, Afghanistan; and *Sitta neumayer subcaeruleus* from Haibak, Afghan Turkestan.

MILLER, ALDEN H. Hybridization of Juncos in captivity. *Condor*, 40: 92-93, 1938.—A male Red-backed Junco (*J. caniceps dorsalis*) mated with a Point Pinos Junco (*J. oreganus pinosus*) and in two seasons nested three times. The young in no instance were raised to maturity, a result probably of improper conditions due to captivity.

MILLER, LOYE. A study of the skull of the Pleistocene stork, *Ciconia maltha* Miller. *Trans. San Diego Soc. Nat. Hist.*, 8: 455-462, pl. 37, May 31, 1938.—Confirms its assignment to the genus *Ciconia*.

MILLER, LOYE, AND HOWARD, HILDEGARDE. The status of the extinct condor-like birds of the Rancho La Brea Pleistocene. *Publ. Univ. California at Los Angeles*, 1: 169-176, pl. 2, 2 figs., 1938.—*Cathartornis gracilis* is referred to Teratornithidae, and all specimens previously referred to it, except two *tarsometatarsi* are otherwise assigned. A new genus, *Breagyps*, is erected for *Vultur clarki* (Miller).

MIRANDA-RIBEIRO, ALIPIO DE. A Seriema—notas ornithologicas XII. *Revista do Museu Paulista*, 23: 35-90, pl. 1-30, Sept. 30, 1937.—A monograph on this aberrant type. Four races are recognized including the typical form. The anatomy, pterylosis, young and adult are illustrated. Its relationships are concluded to be with the cranes on the one hand, the raptorial birds and the Stereornithes on the other. Its long legs are an adaptation to living in open plains.

MIRANDA-RIBEIRO, ALIPIO DE. Notas ornithologicas (XIII) Tinamidae (Inham-bús, Jaós, Taós, Macucos, Codomas, "Perdizes," etc.). *Revista do Museu Paulista*, 23: 667-788, pl. 1-18, 1938.—In this monograph the anatomy and systematic status of seven genera of Brazil are considered, among which the following are named as new: *Nothura schreineri*, *N. spixii*, *Orthocrypturus* (new genus, type species *Crypturus variegatus*), *O. variegatus superciliosus*, *Crypturornis oboleta hymochracea*, *C. soui lyardi*.

MOFFITT, JAMES. Environmental factors affecting waterfowl in the Suisun area, California. *Condor*, 40: 76-84, Mar. 15, 1938.

MONCRIEFF, PERRINE. Birds of Nelson Province, New Zealand. *Emu*, 37: 207-234, pls. 31-32, Jan. 1, 1938.

MOORE, ROBERT T. New races in the genera of *Vireo* and *Buarremon* from Sinaloa. *Proc. Biol. Soc. Washington*, 51: 69-72, May 19, 1938.—New are: *Vireo pallens paluster* and *Buarremon virenticeps verecundus*.

MOREAU, R. E. [Survival of injury by a young bulbul.] Bull. British Ornith. Club, **58**: 113-114, May 27, 1938.

MOUSLEY, HENRY. A study of the home life of the Eastern Belted Kingfisher. Wilson Bull., **50**: 3-12, Mar. 1938.

MURPHÉY, EUGENE EDMUND. Observations on the bird life of the middle Savannah Valley 1890-1937. Contrib. Charleston Mus., no. 9, 61 pp., frontispiece, map, 1937.—A briefly annotated list of the birds seen in forty years of observation in this region on the 'fall line' between South Carolina and Georgia. Under Passenger Pigeon, the last record is of a young male of the year killed September 12, 1893.

MURPHY, ROBERT CUSHMAN. Birds collected during the Whitney South Sea Expedition. XXXVII. On pan-Antarctic terns. Amer. Mus. Novitates, no. 977, 17 pp., fig., May 4, 1938.—The Arctic Tern regularly migrates as far south as the pack-ice belt of the southern oceans; the immature plumage in this and the Antarctic Tern is discussed and figured.

MURR, FRANZ. Gedanken über künstlerische und wissenschaftliche Tierdarstellung. Journ. f. Ornith., **86**: 255-260, 4 figs., Apl. 1938.—Thoughts on depiction of natural subjects from the scientific and the artistic points of view.

PAKENHAM, R. H. W. [A new race of turaco.] Bull. British Ornith. Club, **58**: 111-112, May 27, 1938.—The bird of Zanzibar Island, Jozani Forest, is named *Turacus fischeri zanzibaricus*.

PALMGREN, P., AHLQVIST, H., LANGENSKIÖLD, MÄRTA, AND LUTHER, F. Zur experimentellen Prüfung der Ameisenmimikry. Ornis Fennica, **14**: 96-108, 1937.—Experiments using ants and ant-mimicking spiders offered as food to birds of five species, showed that while ants were usually refused, so also were their mimics, either completely or preponderantly.

PENNELL, F. W. An English obituary account of Thomas Nuttall. Bartonia, (Proc. Philadelphia Bot. Club), no. 19: 51-54, Mar. 8, 1938.—A newly discovered article on Thomas Nuttall has come to light in the files of biographical separates at Kew Gardens, in the shape of a sketch of his life prepared for the local newspaper by his nephew, T. J. Booth. The article supplies some previously unavailable data as to his early life, of his being apprenticed at the age of fourteen for a term of seven years to his uncle, Jonas Nuttall, as a printer, and of his early botanical interest. It appears that it was from this same uncle, not from his father, that he inherited his estate at Nut-grove Hall.

PINTO, OLIVERIO. Nova contribuição à ornithologia Amazonica. Estudo critico de uma colleção de aves do baixo Solimões e do alto Rio Negro. Revista do Museu Paulista, **23**: 493-604, Jan. 14, 1938.—An account of collections recently made on the lower Amazon and the upper Rio Negro, Brazil. Of the many species listed, the following are described as new: *Odontophorus gujanensis snethlagei*, no type mentioned, lower Amazon; *Cranioleuca solimonensis*, from Manacapuru; and *Thryothorus leucotis affinis* from Manacapuru.

QUAINTANCE, CHARLES W. Content, meaning, and possible origin of male song in the Brown Towhee. Condor, **40**: 97-101, May 17, 1938.—The function of song is concluded to be the attraction of a female, after which it ceases.

RABELER, WERNER. Die nordwestdeutsche Verbreitungsgrenze des Schwarzkehlchens und ihre ökologische Deutung. Journ. f. Ornith., **86**: 234-243, Apl. 1938.—Limiting factors in distribution of *Saxicola torquata rubicola*.

RAND, A. L. Results of the Archbold Expeditions. No. 19. On some non-passerine New Guinea birds. Amer. Mus. Novitates, no. 990, 15 pp., May 27, 1938.—New races are: *Anhinga rufa papua*, *Megacrex inepta pallida*, *Ptilinopus iozonus pseudo-*

humeralis, *Geopelia striata papua*, *Syma torotoro brevirostris*, and *Sauromarpis tyro archboldi*, with notes on various rarer species.

RAND, A. L. Results of the Archbold Expeditions. No. 20. On some passerine New Guinea birds. Amer. Mus. Novitates, no. 991, 20 pp., June 2, 1938.—New races: are *Crateroscelis murina pallida*, *Megalurus timoriensis muscalis*, *Rhipidura rufidorsa kubuna*, *Myiolestes megarhynchus palmeri*.

RAND, A. L. Results of the Archbold Expeditions. No. 21. On some New Guinea birds. Amer. Mus. Novitates, no. 992, 3 pp., June 2, 1938.—Evidence that *Dicrurus bracteatus* of Australia migrates to southern New Guinea to winter.

RAND, A. L. Results of the Archbold Expeditions. No. 22. On the breeding habits of some Birds of Paradise in the wild. Amer. Mus. Novitates, no. 993, 8 pp., June 2, 1938.—*Manucodia ater* may pair monogamously and both sexes share in nest duties.

REEB, ANDRÉ. Oiseaux rares ou peu connus en Alsace. Observations ornithologiques. Bull. Soc. d'Hist. Nat. de Colmar, new ser., 25: 195-199, 1937.

REIF, CHARLES. The birds of Frenchman's Bay [, Maine]. Flicker, Minneapolis, 10: 7-9, May 1938.

RIX, C. E. A trip to Eastern Kangaroo Island. So. Australian Ornithologist, 14: 165-169, Apl. 1, 1938.

ROBERTS, N. L. Some ecological aspects of bird life. Part III. Emu, 37: 186-196, Jan. 1, 1938.

ROWAN, WILLIAM. London Starlings and seasonal reproduction in birds. Proc. Zool. Soc. London, ser. A, 108: 51-77, Apl. 22, 1938.—Evidence is given that the skin of the body is the receptor of stimulation of light rays, which act upon the pituitary through this medium.

RYSGAARD, G. N. Chukar Partridge in Minnesota. Flicker, Minneapolis, 10: 3-5, May 1938.—Recently introduced.

SCHAFFER, ERNST. Ornithologische Ergebnisse zweier Forschungsreisen nach Tibet. Journ. f. Ornith., 86: Sonderheft, 349 pp., 111 figs., 2 maps, May 2, 1938.—This special number is devoted to a general account of the habits of birds secured or observed in the highlands of eastern Tibet and on the western borders of China by the Brooke Dolan Expeditions. The different types of country and their characteristic birds are treated in detail with much of illuminating interest in altitudinal distribution. Among other rare species encountered in Tibet was the finch *Koslowia*. Several new races of birds have already been described from this collection.

SCHAFFER, HELMUT. Wovon ernährt sich der Ubu im Gebirge? Beitr. z. Fortpflanzungsbiol. d. Vögel, 14: 21-25, Jan. 1938.—Food of the Eagle Owl in the central Carpathians, found to be largely of mammals.

SCHORGER, A. W. The great Wisconsin Passenger Pigeon nesting of 1871. Proc. Linn. Soc. New York, for 1936: 1-26, Oct. 31, 1937.—An estimated number of one hundred thirty-six million birds was involved in this great nesting.

SEDGWICK, ERIC H. Notes from Nangeenan, Western Australia. Emu, 37: 172-175, Jan. 1, 1938.

SERVENTY, D. L. The King Parrot of Western Australia—*Purpureicephalus spurius* (Kuhl, 1820). Emu, 37: 169-172, pl. 28, Jan. 1, 1938.

SHUEL, RONALD. Notes on the breeding habits of birds near Zaria, N. Nigeria, with descriptions of their nests and eggs. Ibis, (14) 2: 230-244, Apl. 1938.

SILVER, ALLEN. Rosefinch hybrids, etc. Avicult. Mag., (5) 3: 137, May 1938.—Mexican Rosefinch bred to Greenfinch.

SITS, ERIK. Über die Verbreitung des Ortolans, *Emberiza hortulana* L., in NW-Eesti (Estland). *Ornis Fennica*, **14**: 90-95, 5 figs., 1937.

SMITH, J. Breeding notes from New Zealand and Australia. *Avic. Mag.*, (5) **3**: 107-109, Apl. 1938.—Rearing parrots; Galahs relished earthworms, for which they dug.

SMITH, K. D. Notes on Corsican birds. *Ibis*, (14) **2**: 345-346, Apl. 1938.

SOUTHERN, H. N. The spring migration of the Swallow over Europe. *British Birds*, **32**: 4-7, pl. 1 (map), June 1, 1938.—The Swallow (*Hirundo rustica*) tends to follow the average isotherm of 48° F. northward, lagging slightly behind in late March, but by April 1 showing a remarkable coincidence until May 1, "except for a rather quicker spread of the migrants over Central Europe. Beyond this date the isothermal lines are left considerably behind and at Varanger" they are a month ahead.

STANFORD, J. K., AND TICEHURST, CLAUD B. On the birds of northern Burma.—Part II. *Ibis*, (14) **2**: 197-229, Apl. 1938.

STEINBACHER, GEORG. The successful breeding of the Hammerhead and the Boat-billed Night Heron in the Berlin Zoo. *Avic. Mag.*, (5) **3**: 101-103, Apl. 1938.

STEWART, W. Bird notes from upper Loch Fyne. *The Scottish Naturalist*, no. 231: 81, 1938.

STORER, TRACY I. Relations between man and birds in western Europe. *Condor*, **40**: 63-70, figs. 23-25, Mar. 15, 1938.—Bird protection, game management, and sale.

STRESEMANN, ERWIN, MEISE, W., AND SCHÖNWETTER, M. *Aves Beickiana*. Beiträge zur Ornithologie von Nordwest-Kansu nach den Forschungen von Walter Beick (†) in den Jahren 1926-1933. *Journ. f. Ornith.*, **86**: 171-221, Apl. 1938.—Conclusion of this review of the collections made in Kansu by the late Walter Beick; covers the swifts, woodpeckers, cuckoos, raptorial birds, waterfowl, shorebirds and pheasants.

SUOMALAINEN, HEIKKI. The effect of temperature on the sexual activity of non-migratory birds, stimulated by artificial lighting. *Ornis Fennica*, **14**: 108-112, 7 figs., 1937.—Negative effect of temperature but positive effect of lighting is shown.

TAKAHASHI, T. On the unrecorded birds from South Saghalien. (I). *Tori*, Bull. Ornith. Soc. Japan, **9**: 454-472, fig. 143-151, Dec. 1937.

TAVERNER, P. A. An explanation of the local variations occurring in the Great Horned Owls. *Nebraska Bird Review*, **6**: 8-9, Apl. 20, 1938.—The author finds that occasionally winter wanderers remain to breed in localities far from their usual range so that mongrels of two races may thus be produced. This results from the fact that the movements of these birds are more in the nature of wanderings than of regular migration. The case in a way parallels that brought out by Griscom for the crossbills.

THOMSON, A. LANDSBOROUGH. [On the migration of the Pintail.] Bull. British Ornith. Club, **58**: 109-110, May 27, 1938.—Review of Russian results.

TOUT, WILSON. Birds of the Crescent Lake Migratory Bird Refuge. *Nebraska Bird Review*, **6**: 1-4, Apl. 20, 1938.

UDAGAWA, I. Two rare birds from Saitama, Hondo, Japan. *Tori*, Bull. Ornith. Soc. Japan, **10**: 14, pl. 2, June 1938.

VOGT, WILLIAM. Intimidation display in the Eastern Meadowlark. *Proc. Linn. Soc. New York*, for 1936: 96, Oct. 31, 1937.—An exchange of displays between two male birds on territory.

WEBB, C. S. The Buff-throated Sunbird (*Chalcomitra adelberti*). *Avic. Mag.*, (5) **3**: 97-98, col. pl., Apl. 1938.

WHITE, C. M. N. [On the cuckoo-shrike, *Coracina novaehollandiae*.] Bull. British Ornith. Club, **58**: 72-75, Mar. 4, 1938.—In addition to the typical race of Tasmania (migrating to Australia), only one other seems valid, *C. n. melanops*, of Australia except northern Queensland, migrating to New Guinea and sundry islands of Oceania in winter.

WHITE, C. M. N. 1. The races of *Glossopsitta concinna* (Shaw). 2. The races of *Geopelia striata* in Australia. Bull. British Ornith. Club, **58**: 114-115, May 27, 1938.

• WINTERBOTTOM, J. M. Further notes on some Northern Rhodesian birds. Ibis, (14) **2**: 269-277, Apr. 1938.—Among other notes of local movements, the Black-chested Coucal disappears after the rainy season, and the Racket-tailed Roller becomes uncommon during that period.

WITHERBY, H. F. Additions and alterations to the British list. British Birds, **32**: 2-3, June 1, 1938.

WYTHE, MARGARET W. The White-throated Sparrow in western North America. Condor, **40**: 110-116, fig. 33, May 17, 1938.—Summarizes the many records of 'accidentals' west of 100th meridian, and regards these as 'scouts' which may eventually show the way to the regular establishment of the species, at least as a winter resident in California.

YAMASHINA, MARQUIS. On the Formosan birds collected by Mr. H. Orii. Tori, Bull. Ornith. Soc. Japan, **9**: 373-430, Dec. 1937 (Japanese text).

YAMASHINA, MARQUIS. A new genus of the owl. Tori, Bull. Ornith. Soc. Japan, **10**: 1-2, June, 1938.—*Pyroglaux* proposed for *Noctua podargina*, an endemic species of the Pelew Islands.

YAMASHINA, MARQUIS, AND YAMADA, N. Nidification of Formosan birds. I. Tori, Bull. Ornith. Soc. Japan, **9**: 431-469, pl. 8, fig. 121-142, Dec. 1937 (English text).

OBITUARIES

WILL E. SNYDER, who was born in Beaver Dam, Wisconsin, October 29, 1873, a son of the late Mr. and Mrs. Joseph Theodore Snyder, was killed in an automobile accident on November 10, 1937. He was well known to all of the older ornithologists and oölogists in the 'nineties of the last century and for the first thirty years of this century. He was a natural-born collector, very accurate in his identifications and with wide knowledge of the habits of birds. Except for about fifteen years of his early life spent near Farina, Illinois, and one year spent at Point Barrow, Alaska, in the employ of E. A. McIlhenny, collecting specimens, he spent his entire life in Beaver Dam, Wisconsin.

During the latter half of his life he devoted much of his time to building up a collection of Coleoptera, and at the time of his death had one of the largest private collections of North American beetles in the country. He was well versed in bird life of the nation, of which he had made a lifelong study. He was a member of the A. O. U. for over forty years.

On November 18, 1903, he was united in marriage with Miss Errua Crane, of Beaver Dam, who survives him. He is also survived by one son, Wayne Snyder, one grandson and one granddaughter, all of Chicago, and by one sister, Miss Clara Snyder, of Beaver Dam, Wisconsin.—MRS. W. E. SNYDER.

NATHANIEL THAYER KIDDER, a Life Associate of the American Ornithologists' Union since 1906, died at Boston on July 13, 1938. He was the son of Henry P. Kidder (Boston banker and founder of the firm of Kidder, Peabody and Co.) and Caroline W. (Archbald) Kidder. Born in Boston, October 29, 1860, he early became interested in botany and horticulture and graduated with the degree of A.B. in agricultural science from Harvard in 1882 and from the Bussey Institution in 1886. As a business man, he was director in several railroads, and in the latter half of his life was prominent in philanthropic work, giving generously to the support of the Massachusetts General Hospital, the Milton Public Library, the Gray Herbarium, the Boston Society of Natural History, and was a trustee of the hospital and of the Massachusetts Horticultural Society, and for many years was a vice-president of the Boston Society of Natural History. While his interest in birds was largely incidental, as an amateur botanist he was much interested in the work of the New England Botanical Club. His home was at Milton, Massachusetts, where he showed himself a public-spirited citizen and did much to further its civic welfare, particularly in helping the work of the public library and of the historical society and in maintaining the beauty of its shade trees. He was unmarried but devoted himself to the furthering of charitable and educational organizations and delighted in art and literature.—G. M. A.

CHARLES ANDERSON URNER, a Member of the American Ornithologists' Union since 1933, and an Associate for the twelve preceding years, died suddenly and unexpectedly near his home on the morning of June 22, 1938, as he was returning from a meeting of the Linnaean Society of New York. Through his death the ornithologists of New Jersey and New York lose one of their most influential and inspiring leaders. He is survived by a wife, son, daughter and grandson.

Charles Urner was born March 29, 1882, in Elizabeth, New Jersey, where he lived throughout most of his life. After attending the Pingry School he entered the University of Wisconsin and was graduated in 1904, a specialist in dairy bacteriology.

He thereupon entered the Urner-Barry Company, publishers of periodicals for the dairy, poultry, and egg trades, and at the time of his death was vice-president of the company. His great ability and the high respect in which he was held by members of the businesses he served made him an outstanding figure in the industry.

As a young man he was an active sportsman, but his vigorous curiosity and imagination could not be satisfied by hunting, and many years ago he abandoned the gun for the field-glass and notebook. Without exaggeration it may be said that he was richly endowed with the qualities that make a fine naturalist: highly developed powers of observation, an ability to interpret and correlate his observations, a disciplined mind; an inordinate capacity for hard work, and an unbroken enthusiasm for the out-of-doors. During the years 1921-36 he published, in 'The Auk', thirty-nine papers and notes, and during the same period 'The Birds of Union County, New Jersey', in the 'Proceedings' of the Linnaean Society of New York. This last paper was, perhaps, the most important, and few 'local lists' have equalled it. For two and a half years he was New York editor of 'Bird-Lore's' 'Season,' and he supplied much material for Ludlow Griscom's 'Birds of the New York City Region' and Dr. Witmer Stone's 'Bird Studies at Old Cape May.' An active conservationist, he made important numerical studies of shorebirds and waterfowl in New Jersey, was a trustee of the New Jersey Audubon Society, and chairman of the Waterfowl Committee of the National Association of Audubon Societies.

From 1921 to the time of his death he was a member of the Linnaean Society, Secretary 1924-26, President 1929-31, member of the Council more than ten years, and one of ten members to be elected a Fellow in the sixty years of the Society's history. He was a member of the Cooper Ornithological Club, the Delaware Valley Ornithological Club, and a founder of the New Jersey Field Ornithologists Club. The high place he took in ornithological groups was the result both of scientific abilities and personal qualities. He possessed a high zest for life, a friendliness that invariably made him accessible to anyone interested in birds, such a rich sense of humor that it is still impossible to think of him without a feeling of pleasure, an honesty that was uncompromising, and a genius for conviviality. As I have sought for the word that best describes him, I have repeatedly come back to 'generosity.' Those who knew him well for many years never knew him to do or say or think an ungenerous thing.—WILLIAM VOGT.

THE FIFTY-SIXTH MEETING OF THE A. O. U.

The Fifty-sixth Stated Meeting of the American Ornithologists' Union will be held in Washington, D. C., October 17-22, 1938. The headquarters will be at the Raleigh Hotel, and the public meetings will be held in the United States National Museum. Monday will be devoted to business sessions, Tuesday, Wednesday, and Thursday to presentation and discussion of papers, Friday to an excursion, and Saturday morning to a visit to the National Zoological Park. Eleven years have elapsed since the Union met in Washington, and it is hoped that a large membership may be present on this occasion. The city of Washington has been extensively altered by the erection of numerous imposing public buildings since the time of the last meeting, and members may be therefore reminded that there is much to be seen in the way of sights, aside from the features of the meeting.